

CHAPTER 9 ENVIRONMENTAL HEALTH

**FINAL
ENVIRONMENTAL
IMPACT STATEMENT**

**Brightwater
Regional Wastewater
Treatment System**

VOLUME 2

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Chapter 9

Environmental Health

9.1 Introduction

9.1.1 Overview of the Chapter

This chapter discusses the potential environmental health risks, affected environment, impacts, and mitigation measures associated with the various Brightwater System alternatives. It contains several revisions that have been made since the Draft EIS to incorporate new project design information, reference new technical reports that have been completed, and incorporate new information to respond to comments on the Draft EIS. The chapter has also been reorganized, with the major emphasis now placed on alternative “systems,” or combinations of conveyance, treatment plant sites, and outfalls.

King County received comments on the Draft EIS related to environmental health from a number of state and local agencies, public interest groups, and individuals. A number of commentors raised questions and provided comments regarding environmental health risks, in particular during construction and operation of the treatment plants and conveyance facilities. Many questions, comments, and concerns fell into the following categories:

- Risks of hazardous spills/leaks during construction and operation
- Emergency procedures and public notification in the event of an overflow, plant upset, or other event
- Information on the type, location, and frequency of emergency overflows
- Cleanup procedures for hazardous spills/leaks
- Information on the fate and impacts of discharge of treated effluent to human health
- Cleanup plans for spills

The Response to Comments volumes attached to this Final EIS contain specific responses to comments relating to environmental health. The remainder of this chapter incorporates new design information and provides more information on topics identified in comments to the Draft EIS. Where appropriate, sections of this chapter include references to appendices that provide more information on various issues related to environmental health.

9.2 Affected Environment

This section characterizes the affected environment with respect to environmental health in the project area, beginning with a summary of major regulations relevant to environmental health followed by a discussion of the environmental health risk factors that are common to both the Route 9 and Unocal Systems. The section then describes the affected environment for environmental health factors specific to the components of each system, including the treatment plant, conveyance system, and outfall.

9.2.1 Affected Environment Common to All Systems

The affected environment for environmental health is described differently from other elements of the environment discussed in this EIS. While existing conditions relating to environmental health are briefly discussed, the discussion below primarily focuses on those constituents potentially found in wastewater, biosolids, or contaminated soils that could present an environmental health risk. The discussion also includes information on chemicals and gases, either used in or produced by the treatment process, that could pose a potential health or safety risk. These “constituents of concern” are discussed first in general terms, followed by information related to treatment plants, conveyance, and outfall facilities. The potential risk of exposure to these constituents and possible consequences are discussed in the Impacts and Mitigation section later in this chapter.

It is important to note that one of the major purposes of constructing and operating wastewater treatment and conveyance facilities is to reduce potential environmental health impacts. Wastewater treatment is a response to a former environmental health risk. Constructing and operating any large infrastructure project, however, is not without risk.

9.2.1.1 Regulatory Environment Common to All Systems

The regulatory framework for environmental health includes regulations governing wastewater conveyance, treatment, and discharge; water quality in receiving waters; commercial and recreational harvest of shellfish; handling and storage of hazardous materials; biosolids content and application; worker safety; and air emissions. Table 9-1 summarizes the major regulations relating to environmental health.

Table 9-1. Summary of Regulations Relating to Environmental Health

Regulation	Brief Description
<i>Federal Statutes and Regulations</i>	
National Pollutant Discharge Elimination System (NPDES), Federal Clean Water Act 33 USC Section 402, (40 CFR Part 133): Washington State Department of Ecology	Sets limits on effluent discharges from outfalls discharging treated effluent to maintain existing receiving water quality for human health and the environment.
Biosolids Management (40 CFR, Protection of the Environment, Parts 123, 501, and 503): Environmental Protection Agency	Establishes procedures for approving state biosolids management programs and sets requirements that state programs must meet such as reducing pathogens and vector attraction, frequency of monitoring, recordkeeping, facilities management, and compliance with the Endangered Species Act.
Uniform Fire Code (UFC), National Fire Protection Association	Defines codes and standards for physical structures to minimize the risk of fire, explosions, and other hazards. Defines requirements for the use and storage of materials that have the potential to produce conditions hazardous to life and property, including potentially explosive materials stored or used at wastewater treatment facilities. Quantities above the permitted amounts require a permit from the local fire authority. Also requires that Hazardous Material Management Plans (HMMPs) be prepared and submitted to the local fire authority if the local authority requests it.
Occupational Health and Safety Act (OSHA), (Title 29, Part 15): Department of Labor	Helps to ensure safety and health in the workplace.
<i>State Regulations</i>	
NPDES (WAC 173- 220, 221), Washington State Department of Ecology	Ecology is responsible for implementing the federal NPDES permit program at the state level. Requirements for wastewater treatment plant design, construction, and operation are included in the <i>Criteria for Sewage Works Design</i> .
Biosolids Management (WAC 173-308): Washington State Department of Ecology	EPA has delegated administration of biosolids management regulations to Ecology. Regulations are intended to protect human health and the environment when biosolids are applied to land, encourage the maximum beneficial use of biosolids, and conform to all applicable federal rules under the Clean Water Act.

Table 9–1. Summary of Regulations Relating to Environmental Health (cont.)

Regulation	Brief Description
State Regulations (cont.)	
Shellfish Program, Washington State Department of Health	Monitors water quality and shellfish to prevent illness and death from eating molluscan shellfish. Monitors biotoxins, monitors and classifies shellfish growing areas, licenses shellfish operators, and provides information on recreational shellfishing.
Model Toxics Control Act (WAC 173-340-750): Washington State Department of Ecology	Outlines hazardous substance cleanup standards to protect human health and the environment. Applies to release or threatened release of hazardous substances that may pose a threat to human health and the environment. MTCA (Model Toxics Control Act) Cleanup Standards have been developed for releases of hazardous substances to groundwater, surface water, soil and air.
Sediment Management Standards (WAC 173-204): Washington State Department of Ecology	Regulates contaminated sediments, including sediment disposal.
Washington Industrial Safety and Health Act (WISHA) (WAC 296-155, WAC 296-62, Part P): Washington State Department of Labor and Industries	Protects worker safety at construction sites. General occupational health standards have been developed for all workers, including those at contaminated sites.
Local Regulations	
Various Local Regulations and Jurisdictions	<p>Local public health departments, including the Public Health Department of Seattle and King County and the Snohomish County Health Department, monitor drinking water supplies.</p> <p>The Public Health Department of Seattle and King County uses bacterial data collected by King County Department of Natural Resources and Parks at swimming beaches in Lake Washington, and closes beaches for swimming if elevated bacteria levels are found.</p>
Various Local Regulations and Jurisdictions	<p>Local fire departments establish design and construction standards to minimize the risk of hazards in accordance with the National Fire Prevention Association codes and the UFC.</p> <p>The UFC also requires that a Hazardous Material Management Plan (HMMP) be prepared if the fire authority requests it.</p>
Puget Sound Clean Air Agency	Air emission regulations are discussed in Chapter 5.

9.2.1.2 Environmental Health Risk Factors

One of the purposes of wastewater treatment and conveyance facilities is to reduce overall environmental health risks. However, several risk factors associated with the treatment, conveyance, and discharge of wastewater can present environmental health risks:

- Chemicals of concern stored and used at treatment plants and conveyance facilities
- Spills, overflows, leaks, or other releases to the environment, including airborne releases of hazardous materials stored or used at wastewater or conveyance facilities
- Biosolids handling, transport, and application
- Screenings and grit handling, transport, and application
- Discharges of chemicals in treated wastewater to the marine and freshwater environments

These risk factors are discussed below. The potential for exposure to these risk factors as a result of the Brightwater project is discussed under the Impacts and Mitigation section later in this chapter.

Chemicals of Concern

A variety of chemicals are used at treatment plants and certain conveyance facilities to enhance treatment processes, control odors, and disinfect wastewater. Two basic types of chemicals are used, as classified under the Uniform Fire Code (UFC): (1) water reactive and oxidizing materials, which are considered physical hazards; and (2) corrosives and irritants, which are considered health hazards. The following materials commonly used at wastewater treatment plants are water reactive, oxidizers, corrosives or irritants and, as such, are considered potential environmental health hazards under the UFC. This is not an inclusive list but includes chemicals most commonly used at treatment plants. The types of chemicals and their uses are described in Appendix 3-A, Project Description: Treatment Plant.

Sodium Hypochlorite

Sodium hypochlorite is a liquid commonly used as household bleach. At stronger concentrations (12.5 percent vs. 5 percent in household bleach), it is used to disinfect wastewater and control odor at treatment plants and in conveyance lines. It is a strong oxidizing agent and, like bleach, may cause burns to eyes, skin, and the respiratory and digestive tracts. Although nonflammable and noncombustible, sodium hypochlorite is corrosive.

Sodium Hydroxide

Sodium hydroxide is a highly reactive and corrosive liquid with a pH of 14. It is used to manage pH in odor control facilities. It is nonflammable, but may cause fire and explosions when in contact with incompatible materials. It may also cause burns to the eyes or blindness, burns to skin or scarring, burns to the respiratory and digestive tracts, or death if ingested.

Sulfuric Acid

Sulfuric acid is a highly reactive and corrosive liquid with a pH of 2 or less. It is used for pH control in odor control facilities. It is nonflammable, but may cause fire and explosions when in contact with incompatible materials. It may cause burns to the eyes or blindness, burns to skin or scarring, and burns to the respiratory and digestive tracts or death.

Activated Carbon

Activated carbon is used for removal of trace organic contaminants from process air. Activated carbons are manufactured from many materials with a high carbon content, including coal, coconut shells, wood, and peat. It is flammable and may cause slight irritation to the respiratory tract, but will not adversely affect eyes, skin, or digestive tracts.

Calcium Nitrate

Calcium nitrate, also known as Bioxide™, is a type of salt used to control generation of odorous hydrogen sulfide in wastewater conveyance systems. It is a liquid solution that may cause irritation to the eyes, skin, digestive tract, or respiratory tract. It may be fatal if ingested.

Ferric Chloride or Ferrous Chloride

Ferric and ferrous chloride promote sedimentation of liquid sulfides and other suspended solids in wastewater. They can be used at treatment plants or in conveyance lines for odor control or to improve solids settleability. Both chemicals are corrosive with a pH of less than 1. They are eye, skin, and lung irritants, but are non-flammable and non-explosive.

Sodium Bisulfite

Sodium bisulfite may be used to dechlorinate treated wastewater prior to discharge. A type of salt, sodium bisulfite is a liquid solution that may cause irritation to the eyes, skin, digestive tract, or respiratory tract. It may be fatal if ingested.

Polymers

Polymers are synthetic organic substances with an electrical charge that attracts fine particles to form larger particles. Polymers can be in three forms: liquid, dry, and emulsion. Polymers are not flammable, combustible, corrosive, or reactive. They are, however, long chain molecules that contain acrylamide, which can be toxic if ingested. When used in wastewater applications, the organic matter binds with the acrylamide and makes it unavailable.

Spills, Overflows, Leaks, or Other Releases

Spills, overflows, leaks, or other types of releases can occur during construction or operation of any wastewater treatment plant or conveyance facility or during emergency operating conditions. In the very rare event that such a release occurs, hazardous or toxic materials can be introduced to the environment.

The risks of spills during construction of wastewater treatment facilities are similar to the risks posed by other large construction projects. Spills of fuels, oils, lubricants, or other substances can occur during transport to a site and use on a site.

Operation of wastewater treatment and conveyance facilities requires the use of various chemicals for disinfection, odor control, and other processes. These chemicals are described above under Chemicals of Concern. While there is a risk that these chemicals could be released during a spill, modern treatment plants incorporate a number of measures to minimize such risks. These include spill containment provisions, double-walled storage facilities, and emergency cleanup procedures in the event of a spill.

Treatment plant and conveyance facilities also raise local residents' concerns about the risks of exposure to hydrogen sulfide, a gas generated by the decay of waste material, such as organic substances found in untreated wastewater. This colorless gas has a strong "rotten egg" odor even at low levels and can be toxic at high levels (Illinois Division of Environmental Health, 2002). The hydrogen sulfide exposure limit recommended by the National Institute for Occupational Safety and Health (NIOSH) is 10 parts per million (ppm) for 10 minutes over a 10-hour workday during a 40-hour work week period. A level of 100 ppm is the Immediately Dangerous to Life or Health (IDLH) concentration, which means workers exposed to this high concentration must escape within 30 minutes. Under stable flow conditions within existing wastewater facilities, such as those that can occur within pump stations, wastewater treatment plants, or quiescent conveyance lines, hydrogen sulfide gas could build up. Workers at wastewater facilities have the greatest risk of exposure, but members of the public could be exposed by emissions from manhole covers, pump stations, or treatment plants. The potential for exposure to hydrogen sulfide is very low, as described below under Impacts.

Other potentially hazardous gases, including methane, can be generated in wastewater treatment and conveyance facilities. Methane is a colorless, odorless gas produced when organic waste decomposes in the absence of oxygen. Methane is lighter than air and can be trapped in contained spaces. At high concentrations, this nontoxic gas can become explosive.

During extreme storm events or severe system failures, emergency overflows of untreated wastewater can also occur. Depending on the particular wastewater collection and treatment system, such overflows can occur at established safety relief points in conveyance systems, at pump stations, and manholes. Overflows can vary widely in volume and duration, and their effects on human health depend on their proximity to human populations that can come in contact with untreated wastewater. A person could become ill or experience flu-like symptoms if they had sufficient contact with the bacteria, viruses, or protozoa present in the wastewater.

Biosolids Handling, Transport, and Application

Biosolids are the organic, semisolid materials resulting from the wastewater treatment process. Organic solids entering the treatment plant are separated from the liquid wastewater and treated by biological digestion. Anaerobic digestion reduces viruses and pathogenic bacteria by 90 percent or more and reduces the volume of solids by about 50 percent. The resulting treated solids contain nutrients, organic matter, and small amounts of pollutants such as metals and organic chemicals.

King County began treating solids separately in the 1970s, eliminating them from the liquid effluent and applying them to forestry and mine reclamation sites, as well as using them in compost. In 1991, King County began applying biosolids to agricultural lands.

There are two classes of biosolids: Class A and Class B. Class A biosolids have been treated to reduce pathogens to below detectable levels. Biosolids that are sold or given away in a bag or other container, or applied to lawns or home gardens, must meet Class A standards. Class B biosolids have been treated to reduce pathogens to levels that are safe for beneficial uses in land application. Site management and access restrictions are required for lands to which Class B biosolids have been applied.

King County has been monitoring biosolids content since the early 1980s. The quality of biosolids has improved significantly since that time, primarily due to source controls that included requirements for industries to pretreat their wastewater to remove metals, toxins, and other potentially harmful constituents. The result has been a significant drop in contaminants detected in biosolids. For example, analyses of King County biosolids show that from 1981 to 1998, cadmium, chromium, lead, and nickel concentrations decreased 79 to 92 percent, while other metals, such as copper and zinc, decreased 40 to 60 percent.

Biosolids data from King County's West Point Treatment Plant and South Treatment Plant for 2001 indicated that King County's biosolids are of high quality when compared to all relevant federal and state criteria (King County, 2002e). Tests indicated that the

minute concentrations of organic compounds and trace metals were well below all hazardous waste criteria. All metals for which there are federal guidelines were detected at concentrations well below the maximum levels allowable and below the most stringent federal and state limits (WAC 173-308 and 40 CFR Part 503).

Screenings and Grit Handling, Transport, and Application

Other solids collected onsite at treatment plants include debris collected on the influent screens and grit collected downstream of the influent screens in the grit removal process. Screenings consist of coarse solids such as rocks, sticks, rags, plastics and other large objects that interfere with the treatment process. Grit consists of finer materials, mostly inorganic, that have a higher specific gravity than water such as sand, gravel, coffee grounds, eggshells and other materials. Grit is removed to protect downstream equipment from abrasion and prevent accumulation of grit in channels and other areas where the wastewater velocity is slow enough to allow the grit to settle. Both screenings and grit are collected in hoppers, trucked offsite, and disposed of in a landfill in accordance with applicable solid waste regulations.

Discharges of Treated Effluent to Marine Environments

The potential human health risks associated with treated effluents are generally directly or indirectly related to three categories of contaminants: (1) bacteria, viruses, and other pathogens; (2) metals and organic chemicals; and (3) nutrients. Technology-based effluent limits for municipal wastewater treatment plants must comply with Section 40 of CFR Part 133 and WAC 173-221. These regulations set limits for water quality parameters such as pH, biological oxygen demand (BOD), total suspended solids (TSS), and fecal coliform.

Overall, potential environmental health risks associated with discharge of treated effluent are substantially lower than those associated with discharge of untreated or partially treated (e.g., primary) wastewater and represent a very low risk to human health. However, some of these constituents are sometimes detected at very low levels in treated effluent, even when effluent quality standards are met.

Bacteria, Viruses, and Protozoa

Bacteria, viruses, and other pathogens can be discharged to receiving waters from wastewater effluent and other sources, including stormwater. Bacteria are typically one-celled organisms that multiply by simple division in an infected host. Viruses are ultramicroscopic organisms that infect cells in a host, resulting in production of more virus organisms by the host cells. Other pathogens include parasites that are often single-celled organisms that derive nourishment by feeding on the cells of an infected host.

Fecal coliform bacteria are currently used as an indicator to determine the potential presence of harmful bacteria. Fecal coliform bacteria are found in the intestines of warm-blooded animals. They usually are not pathogenic as a group, but are used as indicators for the presence of other pathogenic bacteria or microorganisms such as viruses or protozoa. Although these bacteria are assumed to indicate the presence of other pathogens that could be harmful to humans, there is significant debate about their validity as an indicator of health risk to humans. As part of its revisions to State Water Quality Standards, Ecology recently proposed revisions to the use of fecal coliform bacteria as the water quality standard for bacterial contamination in marine water. The new Water Quality Standards maintain fecal coliform standards for fresh waters. For marine waters, Ecology's new Water Quality Standards maintain the fecal coliform standards of 14 colonies/100 ml for shellfish harvest waters and Primary Contact Recreation marine waters, but now use *Enterococci* for Secondary Contact Recreation waters, or waters used for general boating, wading, fishing, and other uses (mean value of 70 colonies/100 ml) (WAC 173-201A). Ecology's revised standards are subject to approval by the Environmental Protection Agency. At the time of Final EIS printing, the previous standards were still in effect. (See the discussion of Changes in Standards for Treating Wastewater in Chapter 1 of this document.)

Primary Contact refers to activities where a person would have direct contact with water to the point of complete submergence including, but not limited to, skin diving, swimming, and water skiing.

Secondary Contact refers to activities where a person's water contact would be limited (e.g., wading or fishing) to the extent that bacterial infections of eyes, ears, respiratory or digestive systems, or urogenital areas would normally be avoided.

It is very difficult to monitor the presence of viruses in wastewater that is treated to comply with secondary treatment standards. The presence of these pathogens depends on the level of illness in the contributing population, the type of treatment process, and the type of disinfection, among other factors. The process is complicated by the time-consuming and expensive laboratory methods available to measure viruses in wastewater effluent as well as the receiving water.

Studies have been conducted to measure the effectiveness of various types of treatment processes in removing viruses. In general, secondary treatment processes with disinfection are 48 to 96 percent effective in removing viruses in influent wastewater. Comparatively, greater than 99 percent of the fecal coliforms in wastewater influent are typically removed at King County's South Treatment Plant. Activated sludge treatment processes appear to be more effective in virus and bacteria removal than trickling filters (Yahya et al., 2000). Studies conducted for advanced wastewater treatment technology (including membrane bioreactor technology) indicate even higher removal rates of bacteria (Beverly et al., 2002).

In marine and freshwater systems, bacterial and viral contaminants can be transmitted to humans through ingestion of contaminated water or through an open wound while swimming or wading in the water. In marine waters, shellfish can accumulate bacteria

and viruses in their tissues, which, if consumed by humans, can cause illness. Illnesses caused by wastewater-contaminated surface water typically involve gastrointestinal problems that are attributed to the “flu” or other nonspecific causes as well as specific illnesses (e.g., hepatitis A). In many cases, several days can elapse between exposure and symptoms, and the cause may not be apparent.

Cryptosporidium, *Giardia*, and *Entamoeba* are single-celled protozoan parasites of the human intestinal tract that are typically spread through consumption of contaminated drinking water. Infected individuals may shed these parasites into the wastewater system. Secondary treatment and disinfection removes most of these organisms, although they may still be present at very low levels in treated effluent discharged to marine waters. Disease outbreaks associated with protozoan-contaminated marine waters are extremely rare, since most protozoa infections occur from consuming contaminated drinking water. Because their presence tends to be sporadic, it is difficult to generalize regarding the probable concentrations of protozoan parasites in surface waters. Disinfection in the wastewater treatment process kills most of the protozoa, and levels in marine waters are further reduced by 90 percent after about 14 to 143 days (Feachem et al., 1983).

Chemicals

Potential environmental contaminants associated with effluent discharges typically include the chemical and biological agents referred to as constituents of concern. Organic compounds, such as polynuclear aromatic hydrocarbons and metals, may also be present in treated effluent at very low levels following the treatment process. As described in Chapters 6 and 7, metals and organic chemicals may occur in Puget Sound water, may accumulate in Puget Sound sediment, or may bioaccumulate in the biota of Puget Sound. People pursuing recreational activities in Puget Sound or consuming seafood from Puget Sound may potentially be exposed to these chemicals.

Low level exposures to metals and organic chemicals may affect people in two general ways. First, chemical exposures may result in an increase in the lifetime likelihood of developing cancer. Second, chemical exposures, if high enough, may directly affect specific organs or systems such as the skin or liver.

Nutrients

Nutrients are not a direct human health risk factor in marine waters. However, concerns have been expressed by some scientists that increased levels of nutrients could contribute to the production of algae that is harmful to humans. Although algae, in general, are not harmful to humans or animals, some algae in Puget Sound produce chemicals that are harmful to animals and humans. These chemicals, known as biotoxins, can accumulate in the bodies of filter feeders such as clams and other animals such as crabs and snails (DOH, 2002). Outbreaks of natural marine biotoxins in Puget Sound occur unpredictably, usually when conditions favor the growth of organisms that produce the toxins. Biotoxins are not discharged in the treated effluent, but the potential for the nutrients in effluent to cause changes in algae growth patterns is evaluated in Chapter 7. The different biotoxins

evaluated include paralytic shellfish poisoning (PSP) and amnesic shellfish poisoning (ASP).

A microscopic, planktonic organism that grows naturally in Puget Sound produces PSP. The organism, *Alexandrium catenella*, produces toxins that when concentrated in the shellfish can cause death to people and other warm-blooded animals that eat the shellfish. Certain shellfish may be toxic longer than others. Therefore, a PSP closure may be for all shellfish or just certain species.

Domoic acid is a toxic substance produced by microscopic marine organisms, *Pseudonitzschia* spp. Amnesic shellfish poisoning (ASP) is caused by consumption of shellfish and other filter-feeding invertebrates contaminated with domoic acid. This neurotoxin was first detected on the west coast of the U.S. in 1991. Mild symptoms include nausea and vomiting, cramps, dizziness, and confusion. In more severe cases neurological symptoms may include headache, dizziness, confusion, disorientation, loss of short-term memory, seizures, and even death. Monitoring for these biotoxins is carried out routinely in all western U.S. states and in Canada.

The Washington State Department of Health Biotoxin Program performs year-round monitoring of PSP and ASP in molluscan shellfish from both recreational and commercial harvest areas (<http://www.doh.wa.gov/ehp/sf/BiotoxinProgram.htm>) and lists beaches that are closed to recreational harvest in their Biotoxin Bulletin (<http://ww4.doh.wa.gov/gis/biotoxin.htm>).

9.2.2 Affected Environment: Route 9 System

This section discusses the affected environment with respect to environmental health for the components of the Route 9 system, including the treatment plant, conveyance facilities, and outfall.

9.2.2.1 Treatment Plant and Conveyance: Route 9

The affected environment relating to environmental health for the Route 9 System pertains mainly to water supply sources and contamination sites. The Route 9 site is located in the southwest portion of the Cross Valley Water District service area. Some private wells are also located in this area. The District provides water to residents, businesses, and public schools in the vicinity of the site, and approximately 89 percent of the District's supply comes from groundwater. Of the District's 10 wells, the closest well to the Route 9 site is the Woodlane well, located approximately 3,000 feet east and upgradient of the site, meaning that groundwater from the Route 9 site drains away from this well. The remaining nine wells are located farther away from the site, also upgradient of the site.

One property at the Route 9 site is on Ecology's Model Toxics Control Act (MTCA) list of suspected and confirmed contamination sites. It has been ranked by Ecology as a 5, the

lowest level of risk, and is subject to remediation requirements. There is no water contact recreation on or in the immediate vicinity of the Route 9 treatment plant site.

The 195th Street conveyance corridor passes approximately 600 feet south of the Olympic View Water and Sewer District's Deer Creek Spring wellhead protection area (4,000 feet from the spring itself) and through the wellhead protection area for the Lake Forest Park Water District. The corridor also reaches but does not extend into the wellhead protection area for the Cross Valley Water District.

The 228th Street corridor also passes directly by the Olympic View Water and Sewer District's 228th Street Well. The District has been working on this well for several years under a water permit from the Washington Department of Ecology, and although not currently using it, may do so in the future. Recently, the deeper aquifer, in which the well was originally completed, was found to have unacceptable water quality, so the well was modified to allow development of the shallower aquifer. Both the 195th Street corridor and the 228th Street corridor pass through the southern portion of the Chevron Richmond Beach Asphalt Terminal property at the Puget Sound shoreline. This property has documented contamination associated with leakage from bulk fuel storage operations. Evaluations show that contamination consists of hydrocarbons including gasoline, diesel, and motor oil. Two of the six contamination areas documented on the property are in the southern portion of the site. Remediation efforts have been underway for more than a decade under the jurisdiction of Ecology.

Portal 41 Influent Pump Station Option

The affected environment for the Portal 41 IPS Option is included within the discussion of the overall Route 9 System and the 195th Street Corridor.

9.2.2.2 Outfall: Route 9

The marine waters of the Central Basin of Puget Sound (excluding Elliott Bay) have been designated by Ecology under new use-based standards for aquatic life, shellfish harvesting, primary contact recreation, and secondary contact recreation (WAC 173-201A, revised July 2003). This includes outfall Zone 7S. Refer to the discussion under Discharges of Treated Effluent to Marine Environments above. As noted, these new standards are subject to approval by the Environmental Protection Agency.

Currently the shoreline of Snohomish County is closed from Tulalip Bay south to King County for commercial shellfish harvesting due to Washington State Department of Health concerns about effluent from the Edmonds, Lynwood, Alderwood, and Olympus Terrace sewage treatment plants in addition to the large number of potential nonpoint pollution sources in this area. Recreational shellfish harvesting still occurs in the project vicinity but is not recommended (Woolrich, personal communication, 2003). The Department of Health has not surveyed these sources or determined their individual impacts, but they believe it would be "extremely difficult to insure that shellfish harvesting could be safe from those shorelines" (Woolrich, personal communication,

2003). No shellfish beds have been reopened to commercial harvest in King or Snohomish Counties.

King County has conducted an extensive surface water and sediment monitoring program within both potential outfall Zones 6 and 7S. For all constituents monitored, existing contaminant levels met all applicable water and sediment quality standards and criteria, with the exception of occasional violation of fecal coliform bacteria standards in nearshore monitoring locations where stormwater discharges may influence water quality.

Zone 7S is located offshore of Point Wells. The shoreline area in this zone is primarily private property with limited public access. The closest public boat launches are located at the Edmonds Marina and at the Shilshole Bay Marina in North Seattle. Richmond Beach Park lies 0.75 mile south of Point Wells in the City of Shoreline in King County. Water contact activities in this park, which provides beach access, include shellfish harvesting, swimming, and other beach-related activities (King County, 2002a). Boating, fishing, and SCUBA diving occur infrequently in this area due to the lack of a boat launch or fishing pier; however, people may visit this area by boat. Refer to the discussion under Treatment Plant and Conveyance, above, regarding documented contamination at the Point Wells site.

9.2.3 Affected Environment: Unocal System

This section discusses the affected environment with respect to environmental health for the components of the Unocal system, including the treatment plant, conveyance facilities, and outfall.

9.2.3.1 Treatment Plant and Conveyance: Unocal

The affected environment for environmental health for the Unocal system relates to water supply, water-based recreation, and contaminated soils or groundwater. The Olympic View Water and Sewer District serves residents in the south Edmonds area of Snohomish County and derives its supply from the Deer Creek Spring complex. The Lake Forest Park Water District encompasses the central portion of the Brightwater project area where it abuts Lake Washington. The District operates eight shallow artesian wells and three deeper production wells, with one additional deep well not presently in use.

Two water-based recreation parks are located near the Unocal site: the Edmonds Fishing Pier and the City of Edmonds Marina Beach Park. Brackett's Landing Park and swimming beach are located to the north of the site. Unocal had leased Marina Beach Park to the City of Edmonds until December 2001, when the City purchased approximately 5 acres of Puget Sound shoreline, which included the park. Water-based amenities include water access and a City of Edmonds designated Marine Protected Area (MPA) (Edmonds, 2001). MPAs are areas of intertidal or subtidal terrain, together with

their overlying water and associated flora, fauna, historical and cultural features, that have been reserved by law or other means to protect or manage species, habitats, and ecosystems (Murray and Ferguson, 1998). Different levels of protection, access, and use are associated with different MPAs. The MPA associated with Marina Beach Park is permitted for human access; however, consumptive uses are not allowed.

Hazardous materials such as petroleum products or other contaminants in soil or groundwater are present at the Unocal treatment plant site in various concentrations and distributions. Cleanup efforts have been scheduled for the Unocal site. It can be assumed that some soil and groundwater contamination would be encountered during the large-scale excavation required for the Brightwater Treatment Plant.

The Unocal corridor passes about 2,200 feet south and southwest of the Lake Forest Park Water District Wellfield. This location is downgradient or cross gradient from the wellfield.

9.2.3.2 Outfall: Unocal

As mentioned above under the Route 9 outfall, King County has conducted an extensive surface water and sediment monitoring program within both potential outfall zones, Zones 6 and 7S. For all constituents monitored, existing contaminant levels met all applicable water and sediment quality standards and criteria, with the exception of occasional violation of fecal coliform bacteria standards in nearshore monitoring locations where stormwater discharges may influence water quality.

Outfall Zone 6 is located just south of the Edmonds Ferry Terminal and Edmonds Marina. Recreational areas near Zone 6 include Olympic Beach, Brackett's Landing Beach, Edmonds Fishing Pier, Edmonds Marina, Marina Beach Park, and the Edmonds Underwater Park. Water-based recreational activities in this area include boating, fishing, SCUBA diving, shellfish harvesting, swimming, walking, and other beach-related activities (King County, 2002a). SCUBA divers use the Edmonds Underwater Park and the area near the Edmonds Beach Marina Dock, which extends into Puget Sound just south of the marina, from Marina Beach Park. In addition, the Edmonds Beach Rangers lead educational classes on the shorelines with large groups of visitors.

According to information collected during field and telephone interviews conducted for the project, these areas attract a large number of recreational visitors (King County, 2001, 2002b). Zone 6 has more designated recreational facilities and a greater number of visitors than does Zone 7S. Refer to Chapter 14 for additional discussion of recreation along the shoreline near Zones 6 and 7S.

9.3 Impacts and Mitigation

In this section, impacts are characterized first by those impacts common to all systems, followed by a discussion of impacts specific to the Route 9 and Unocal Systems and the No Action Alternative. For environmental health, impacts are generally discussed in terms of risk, particularly risk of exposure to contaminants and potential effects during both construction and operation.

9.3.1 Study Methodology

This environmental health evaluation was conducted by reviewing available literature on environmental health issues associated with wastewater treatment plant, conveyance, and outfall system construction and operation. Information was collected from research organizations associated with the wastewater treatment industry, as well as public health reviews and operating histories from King County wastewater treatment and conveyance facilities. Information relating to storage and use of hazardous materials was obtained from literature sources including the UFC and the EPA's Integrated Risk Information System (IRIS) database.

King County identified effluent constituents of concern for discharge to the marine environment (Parametrix and Intertox, 2002). Many of these constituents do not have federal or state Water Quality Standards. In order to address these constituents, King County used toxicological information developed by the EPA to estimate the potential for chemicals to affect human health. The following methodology was used to address these constituents:

- Determine how people could be exposed to effluent discharged from the Brightwater marine outfall during normal operations (exposure pathways)
- Estimate constituent concentrations in the Brightwater secondary treated effluent (effluent concentrations)
- Estimate the level of effluent dilution that would be achieved where people may be exposed (such as swimming beaches)
- Calculate the level of exposure to the metals and organic chemicals that would occur through consuming seafood or playing on the beach or in the water
- Using the EPA's toxicological information, calculate the likelihood that chemicals will result in non-carcinogenic effects
- Using the EPA's toxicological information, calculate the increase in the lifetime cancer risk

For the EIS and outfall siting process, King County used the PLUMES model (EPA, 2003) to estimate the dilution of secondary treated effluent that would be discharged from the Brightwater marine outfall under both system alternatives. For the Final EIS, the model was re-run to incorporate a wider variety of oceanographic and plant operating conditions for the chosen treatment technology of split-flow membrane bioreactor (MBR). This model was run for each alternative outfall location (Zones 6 and 7S) with proposed diffuser designs and effluent flows, along with information on seasons and oceanographic current speeds. The County selected these scenarios to provide a reasonable evaluation of impacts from operating conditions over the life of the Brightwater Treatment Plant. The modeled scenarios capture plausible worst-case conditions (minimum initial dilution) for the Brightwater marine outfall (Appendix 6-H, Predesign Initial Dilution Assessment). As part of the Dilution Assessment, King County also modeled effluent transport throughout Puget Sound. This model was used to predict long-term transport and dilution throughout Puget Sound.

9.3.2 Impacts and Mitigation Common to All Systems

The following section describes the potential impacts relating to environmental health that are common to all of the action alternatives being considered for the Brightwater system. The impacts associated with construction and operation of the treatment plant are discussed first, followed by the conveyance system and the outfall.

9.3.2.1 Treatment Plant Impacts Common to All Systems

Construction Impacts Common to All Systems: Treatment Plant

Construction impacts at both treatment plant sites relate to potential exposure of individuals to contaminated soils or groundwater, and exposure to spills or leaks during construction. The potential for spills, leaks, and other releases during construction to affect drinking water supplies is also discussed below.

Contaminated Soils and Other Materials

At both treatment plant sites, there is a potential for construction to disrupt and expose contaminated soils or groundwater. Contaminants attached to soil particles could become airborne. The greatest risk of exposure to contaminants would be to construction workers at the site from the inhalation of dust particles. All site work involving contaminated soils would be conducted in compliance with the Model Toxics Control Act administered by Ecology; site work with contaminated soil requires special training and monitoring under OSHA/WISHA regulations. All construction areas would be fenced to prevent access by the public.

Groundwater from dewatering would be tested to ensure that it is not contaminated before disposal. Contaminated groundwater may be treated at the site or hauled to a certified facility licensed to handle the material. More information on the types of hazardous materials that are or may be present in the soils or groundwater at the treatment plant sites is discussed in Chapters 4 and 6; potential airborne emissions are discussed in Chapter 5.

Demolition would be required at both treatment plant sites. Prior to demolition, any materials containing asbestos or lead would be removed in accordance with WISHA requirements by a licensed abatement company. Materials would be disposed of at licensed sites.

Spills, Leaks, and Other Emergencies

Spills of hazardous or toxic materials could occur during construction of the treatment plant at either the Route 9 or Unocal site. These materials could include petroleum products, solvents, lubricants, and other materials used for operating construction equipment. The types of spills that could occur are typical of those that could occur at any large construction site. The volume potentially spilled would likely be the amount within a fuel tank or otherwise stored onboard a vehicle, which would be a maximum of approximately 250 gallons of diesel fuel or hydraulic fluid for most of the heavy construction vehicles entering and leaving the site (Eggebrecht, personal communication, 2002).

Construction plans for the treatment plant would include spill containment provisions and response kits to prevent offsite transport of spilled materials, but construction workers could still potentially come in contact with the spilled fuel or hydraulic fluid. Construction workers would have available safety and cleanup equipment, including absorbents and other materials to deal with all the potential types of spilled materials.

King County would be ultimately responsible for responding to any other emergencies that occur on construction sites. The County would rely on local emergency response resources, including units specially trained and equipped for special circumstances (Wood, personal communication, 2003). King County is currently working with local fire districts and emergency responders to identify emergency response issues associated with Brightwater and to address emergency response needs through appropriate staffing, equipment, specialized training such as confined space rescue, and other resources.

King County would require contractors to submit as part of the contract documents a section on environmental controls, which would include an oil spill prevention and control plan. This document, submitted to the County prior to construction, would be subject to King County's review and approval. It typically includes measures for inspecting fuel hoses, equipment, and facilities; containment for storage tanks; immediate containment of visible oils on land using dikes, straw bales, or other appropriate measures; and agency notification in the event of discharge to public waters or onto land with a potential for entry into public waters. In addition, contractors would be required to

adhere to a Spill Prevention, Containment, and Control Plan as required under the Stormwater Pollution Prevention Plan for the project (see Chapter 6 for more information).

No impacts to drinking water supplies are anticipated during construction on either treatment plant site. The closest public drinking water supply wells are upgradient of both sites, meaning that any spills would flow away from the sites and would not be adversely affected by any spills or leaks on the site. Refer to Appendix 6-B, Geology and Groundwater, for more information.

Operation Impacts Common to All Systems: Treatment Plant

Impacts from treatment plant operation are related to the following sources of environmental health risk:

- Materials stored and used at treatment plants
- Spills, leaks, or other releases to the environment, including airborne contaminants
- Emergency overflows
- Biosolids handling, transport, and application
- Reclaimed water
- Grit and screenings handling, transport and disposal

These potential impacts are discussed below.

Materials Stored and Used at Treatment Plants

A wide variety of chemicals would be used and stored at either the Route 9 or Unocal site, including substances classified as health hazards in Appendix V1-A of the UFC. Section 105 of the UFC defines quantities of these chemicals that have the potential to produce conditions hazardous to life or property. Any storage or use of materials in excess of listed quantities would require a permit from the local fire authority. Materials used for the Brightwater Treatment Plant would exceed these threshold levels and would therefore require a permit from the appropriate local fire department.

The chemical building at both the Route 9 and Unocal sites would be used to store and distribute chemicals for odor control, ballasted sedimentation, and disinfection. Odor control chemicals would include sodium hypochlorite, sodium hydroxide, and sulfuric acid. Ballasted sedimentation chemicals would include iron salts (ferric chloride). Sodium hypochlorite would be used for effluent disinfection and prechlorination of the influent. Polymer would be used for thickening and dewatering, while citric acid would be used for membrane cleaning. Chemicals would be delivered by truck and stored onsite

in bulk storage tanks. Polymer may be delivered in bulk liquid or dry form, diluted into solution onsite, and stored in the solids handling building.

All chemical storage and handling would be designed to comply with the applicable local, state, and federal regulations, such as the UFC regulations for tank leakage, spill control, and secondary containment (Section 8003.1.3 UFC); the Resource Conservation and Recovery Act (RCRA); and OSHA. Most of the chemicals would be delivered by trucks with a typical capacity of 4,800 gallons and stored onsite in solution form. For example, the sodium hypochlorite would be delivered in 12.5 percent solution. The sodium hydroxide solution and the sulfuric acid solution would have strengths of 50 percent and 98 percent, respectively. The onsite storage would provide approximately 15 days storage capacity for each chemical. The dry polymers would be delivered in bags and stored in bags, tanks, or bins. Bags would be stored in a cool, dry location above floor level to allow for easy, safe access and provide dust control and effective cleanup. Storage tanks and bins would be designed with double walls to minimize the risk of release from tank leakage and set on concrete pads, with spill containment berms and high and low level indicators to allow continuous feeds. The chemical building would be provided with appropriate ventilation and alarm systems in case of emergency. The risk of spills, leaks or other releases, along with provisions to address such situations, is discussed below.

Spills, Leaks, or Other Releases

The Brightwater Treatment Plant would be designed in accordance with all applicable Ecology and UFC requirements, which include spill containment requirements. Areas used for loading and unloading materials would include spill containment. The UFC includes requirements for appropriately sized liquid-tight floor containment and special sumps and collection systems to treat these areas separately from the remainder of the plant's stormwater system. Stormwater would be collected and segregated from areas of the treatment plant where there is a risk of chemical or biosolids leaks or spills, such as loading areas, and then routed to the treatment plant to ensure that leaks or spills are contained and treated, and not discharged untreated to adjacent surface waters. The greatest potential exposure would be to treatment plant operators; the risk of hazardous or toxic materials being transported offsite is minimal. There have been no documented incidents of chemical spills at King County treatment plants that resulted in any danger to individuals outside of the facility boundaries (Alston, personal communication, 2003). Emergency spill response procedures would be in place at all facilities, and employees would be trained to respond appropriately.

At the treatment plant sites, physical hazards such as potentially explosive conditions, including gases within the digesters, would be subject to stringent design requirements to minimize the potential for explosion. Both the National Fire Protection Association guidelines and the UFC requirements would be applied by local fire districts. Explosions within the wastewater collection and treatment system are extremely rare; King County has never had an explosion with its current collection and treatment system (Cox, personal communication, 2002).

A recent concern relating to wastewater facilities is the potential threat of terrorist activity, which could result in a spill or release of untreated wastewater. While possible, a terrorist attack on a wastewater conveyance system is unlikely because it would not cause an immediate risk to a large number of people. An attack on a potable water supply, for example, would be more likely. However, in response to recent world events, King County has developed a new security program for its wastewater facilities. Operation of the Brightwater facilities would incorporate measures identified by the new security program as well as typical security measures currently used at the West Point and South Treatment Plants. Such security measures include restricted access to treatment plant and conveyance facilities (pump stations, regulator stations, etc.). Offsite facilities such as pump stations are kept locked when King County staff are not present at the facility. Fencing or high-berm walls with gated ingress and egress secure treatment plants. During operating hours, visitors are required to check-in with the plant administration building and to be escorted by plant employees when visiting facilities onsite. Security cameras are located at the access gates. After operating hours, access gates are closed and locked, and in the past, security personnel have been employed at the treatment plants. In the event of criminal trespassing, treatment plant staff rely on local police to respond (Dawson, personal communication, 2003).

King County responds to emergency incidents in accordance with the *King County Emergency Management Plan*. The *Emergency Support Function 3* portion of this Plan outlines King County's roles and responsibilities relating to the restoration and continuity of public works functions, including wastewater treatment, in the event of natural disasters or emergencies resulting in the release of hazardous materials (King County, 2003). Emergency procedures are also contained in the Wastewater Treatment Division's *Emergency Response Plan* (King County Publication 280). Each treatment plant has its own version of this plan, and a specific version for the Brightwater plant would be developed once the design of the plant is complete. These procedures are used to handle fires, medical emergencies, hazardous material releases, power outages, violence and terrorist acts, earthquakes, and other natural disasters, as discussed above.

Specific evacuation procedures for potential hazardous material releases at the Brightwater plant would not be required since no gaseous chlorine would be used at the treatment plant.

No impacts to drinking water supplies are anticipated during operation on either treatment plant site. As previously discussed, the closest drinking water supply wells are upgradient of both sites and would not be adversely affected by any spills or leaks on the site. Refer to Appendix 6-B, Geology and Groundwater, for more information.

Airborne Releases (Aerosols)

In addition to constituents of concern discussed above, treatment plant sites have the potential to generate airborne releases, including aerosols. Aerosols are microscopic airborne droplets that may be carried through the atmosphere. Aeration basins and other aerated process points in a wastewater treatment plant can serve as a source of aerosols.

At wastewater treatment facilities, these aerosols may contain particulates, toxic chemicals, and viable microorganisms, some of which may be pathogenic to humans.

Overall, airborne emissions from the treatment plant would not present an environmental health concern. All emissions would be in compliance with air quality regulations; refer to Chapter 5 for additional discussion. The population of individuals that would receive the greatest exposure to airborne particulates, toxic chemicals, and pathogens would be workers at the treatment plant. The potential for the public to be exposed to aerosols is very low as the design of the liquid treatment processes includes covers for all liquid processes. Emissions of aerosols from the liquid processes would be collected by the covers and either re-entrained in the wastewater, or sent to three-stage chemical scrubbers, followed by carbon odor control scrubbers.

Volatile organic compounds (VOCs) are present in wastewater and are emitted at wastewater treatment plants. Emitted also by both industrial and area-wide (e.g., transportation) sources, VOCs contribute to atmospheric photochemical reactions that may lead to the production of ozone. The VOC emissions from a facility may include chemicals that are not only photochemically reactive but also toxic. Chapter 5 discusses air and odor emissions, including emissions of toxic chemicals from the treatment plant sites. Ozone in the lower atmosphere is a harmful air pollutant that contributes to the formation of smog. It is a secondary pollutant formed by the reaction of hydrocarbons and nitrous oxides in the presence of strong sunlight. Ozone is a pungent, colorless gas that is an irritant to lungs and respiratory functions. Individuals with chronic respiratory problems (such as asthma) are most sensitive to elevated ozone levels. The treatment plant would not be a significant contributor of VOCs, as described in Chapter 5. Therefore, the treatment plant would be a minor contributor to ozone production.

Combustion sources would also be present at the treatment plant. Combustion sources, which emit criteria pollutants and toxic air pollutants, are discussed in greater detail in Chapter 5.

Emergency Overflows

One of the major purposes of the Brightwater project is to prevent overflows and discharges of inadequately treated wastewater. Implementation of the project would reduce the risk of emergency overflows by increasing King County's capacity to treat wastewater and its flexibility to handle emergencies. This would result in fewer potential risks to environmental health compared to not constructing the plant (see the section titled No Action Alternative later in this chapter).

During emergencies, when storm-influenced flows exceed the capacity of the treatment plant or conveyance system and when multiple equipment and power failures occur, overflows would be possible. King County's emergency flow management system, described in Chapter 3 under Conveyance Safety Relief Point, includes five levels of management. Though it would be a very rare event resulting from extreme conditions, the potential event must be planned for and designed into the system.

During extreme events, when all flow management procedures are being used but flows in the system do not decrease, controlled overflows of untreated wastewater could occur. These overflows, referred to as sanitary sewer overflows, may originate at individual pump stations, at the marine outfall, or at a conveyance system safety relief point in the Sammamish River near the existing Kenmore Pump Station. Safety relief would help to prevent backups into local systems, homes, and businesses. The King County Brightwater conveyance system would be sized to accommodate flows up to 170 million gallons per day (mgd), which is the estimated flow at the Brightwater Treatment Plant during a 20-year peak flow event in 2050. Assuming a constant peak flow of 170 mgd, the probability of such an occurrence due to varying combinations of mechanical and power failures would be at most once in every 100 years for initial phases of the treatment plant and once every 75 years upon buildout of all phases of the treatment plant.

Potential effects from emergency overflows could include immediate, but short-term, public health impacts. An emergency overflow would have a temporary adverse impact on environmental health by increasing concentrations of bacteria, viruses, and toxicants in receiving waters. The Sammamish River shoreline, nearby areas along the Lake Washington shoreline, and Puget Sound could receive debris as well as contaminated sediments following an overflow event. Overflows tend to occur during extreme storm events when in-water recreation is low, but people could come into contact with contaminated sediments or debris while walking along shoreline areas immediately following an overflow event.

The King County *Wastewater Treatment Division Overflow Manual* (King County, 2002d) establishes response procedures for emergency wastewater overflow events. The Seattle/King County Department of Public Health (Health Department) would be notified during all overflow events. If an overflow is known to impact a beach or recreation area creating a potential public health threat, beach postings notifying the public that it is unsafe to come in contact with water, sediments, or debris along the beach. Beach closures may be immediately implemented as well. The Overflow Manual also identifies procedures for contacting media and conducting public outreach. The County would also monitor water quality to determine when water contact would be safe. Such efforts would minimize the public health risk; however, as previously noted, emergency overflows occur only when all other flow management measures have been exhausted.

Refer to Chapter 3 for more discussion of the emergency overflow management approach and Chapter 6 for a discussion of the water quality implications of emergency overflows.

Biosolids Handling, Transport, and Application

As described in the Affected Environment section of this chapter, the potential for the public to be exposed to Class B biosolids is extremely low. Possible exposure pathways include a release due to an accident during transport, contact with biosolids at an application site, or contact during biosolids transfer at the treatment plant site.

At both treatment plant sites, an enclosed truck bay would be used to load dewatered biosolids into hauling vehicles; the biosolids transfer area within the site would not be accessible to the public. The treatment plant would also be designed to minimize exposure for workers as the biosolids are dewatered and loaded into haul trucks. Dewatered biosolids would be transported from the treatment plant to field application sites in custom-designed dump trucks and trailers. The *Biosolids and Grit Haul Driver's Handbook* (King County, 2000) describes steps to be taken in the event of a spill or collision. Hazardous materials response teams are not required because of the low toxicity of biosolids. Drivers would, however, be required to implement containment measures to prevent any spills from entering water bodies.

As described in Chapter 3, biosolids produced by the Brightwater Treatment Plant would be treated to a Class B level of pathogen reduction, but space would be reserved at the treatment plant site to reach Class A standards in the future. Biosolids would be transported to eastern Washington for application to agricultural lands or to eastern King County for application to forest lands, and/or they would be made into compost. Any biosolids treated to a higher level (Class A) would have more recycling options. These biosolids could be used in the current land application program, added to topsoil mixes, or distributed for public use.

Risks from exposure to pathogens at application sites are managed through either processing or site access restrictions. Contact with biosolids at an application site in eastern King County or eastern Washington is unlikely given the remoteness of these sites and the barriers to public access (gates and signs). Class B biosolids have been treated to significantly reduce pathogens, but because some pathogens may remain, access to application sites must be restricted for at least 30 days. Class A biosolids have been processed to reduce pathogens to below detectable levels. These biosolids can be sold or given away in a bag or other container for use on lawns and in home gardens.

To manage other risks such as surface water contamination or over-application of nitrogen, King County biosolids are recycled in compliance with federal and state regulations (40 CFR Part 503 and WAC 173-308), the State of Washington's best management guidelines, and the national Biosolids Code of Good Practice. For Class B biosolids, all these standards require agronomic application rates, public access restrictions, crop and livestock waiting periods, and buffers or setbacks from water bodies and other sensitive areas. These measures are designed to protect the public and the environment from potential negative impacts associated with poor management of biosolids.

Risks from metal pollutants in biosolids are managed by meeting risk-based standards for biosolids quality. During the development of federal biosolids regulations, the EPA identified 14 pathways of potential exposure to biosolids after land application, such as a child eating biosolids or a person eating fish or drinking surface waters from a biosolids application site. These potential effects were quantified and used to develop numerical standards for metal pollutants in biosolids. The concentrations of metals in King County biosolids are well below the EPA's most stringent standards and limits for these pollutants (King County, 2002c).

Additional information on King County's biosolids management system and the impacts of handling, transporting, and applying biosolids can be found in Appendix M of the *Final Environmental Impact Statement for the Regional Wastewater Services Plan* (King County, 1998).

Reclaimed Water

Both the Route 9 and Unocal sites would produce reclaimed water. Treatment of reclaimed water using an MBR process would also include disinfection. Reclaimed water would be made available to end users to irrigate food crops, non-food crops, and open access areas such as parks and golf courses. Water would also be used onsite at each treatment plant to irrigate landscaped areas and for process water to clean equipment.

Water would be disinfected using UV and treated to Class A standards, which limits total coliform levels to less than 2.2 organisms per 100 ml. Washington's Water Reclamation and Reuse Standards have been developed by Ecology and the Washington Department of Health to protect public health and prevent any adverse environmental health impacts.

Screenings and Grit Handling, Transport and Disposal

All screenings and grit at the Route 9 and Unocal sites would be handled, transported and disposed of in accordance with Ecology requirements. Transport would be handled in a manner similar to that described for biosolids above. There would be minimal opportunity for the public to come in contact with screenings at either site because such areas have limited public access. Disposal would occur at a landfill in accordance with all applicable requirements to protect public health.

9.3.2.2 Conveyance Impacts Common to All Systems

Construction Impacts Common to All Systems: Conveyance

Environmental health risks during construction along the conveyance routes at connections to local sewer systems, and at all primary and secondary portals (if secondary portals are used), would include exposure of workers or surrounding residents to materials that spill or leak. Impacts from such releases, should they occur, would be similar to those associated with construction of the treatment plant, except at a much smaller scale. Potentially spilled materials would largely include fuel and hydraulic fluid for construction equipment and construction materials such as concrete. Construction at all portal and other conveyance-related construction sites would be subject to onsite spill containment procedures consistent with the requirements of the local jurisdiction. Potential environmental health risks would be minimal. However, even with these provisions it is possible that onsite spills could temporarily expose workers or nearby residents to contaminants or enter the storm drainage system near construction sites.

There is the potential at portal sites to contaminate deeper aquifers by excavating through contaminated shallower aquifers and aquitards at portals. Construction fuels, chemicals, and lubricants released within a shaft potentially have direct access to subsurface areas. In addition, tunnel construction would require the use of grout and bentonite. However, the probability of these impacts is considered low. Inward pressure from groundwater in portal shafts and tunnels would limit the opportunity for contaminants to enter groundwater, including aquifers used by water districts in the project area for water supply. In addition, the sides and bases of shafts would be sealed to minimize groundwater contamination potential. Refer to Chapter 6 and Appendix 6-B, Geology and Groundwater, for more information on groundwater contamination potential during portal construction.

Some existing groundwater collected during dewatering may be contaminated, particularly in the vicinity of Portals 11 and 19, which are located in industrial areas. Similar to treatment plant sites, contaminated groundwater would be handled separately at construction sites, which may include transport for disposal offsite. Additional site-specific investigation would occur following determination of final portal sites, and potential contamination issues would be further defined. All dewatering would be conducted in accordance with Ecology requirements.

Ground freezing may also be used during portal construction. The most common method used to provide refrigeration energy to freeze the ground consists of a primary refrigerated compressed gas, usually ammonia. Refrigeration units are self contained and protect against release of ammonia by a series of safety systems. Ammonia would be delivered to the construction sites and recovered by licensed distributors and transporters. Transfer lines would be equipped with detectors, and suitable protective equipment would be provided for workers in case of any detected release.

As with treatment plant sites, King County would continue to coordinate with local emergency service providers to develop specific protocols to address emergencies during construction.

Operation Impacts Common to All Systems: Conveyance

Spills, Leaks, or Other Releases

Operational impacts associated with conveyance facilities include the potential for spills and leaks or other releases to the environment, and the potential for emergency overflows. Conveyance facilities would consist of pipelines, including gravity pipelines and in selected areas, force mains, pump stations, diversion or transition structures between pipelines, odor control facilities, and dechlorination facilities. The Brightwater conveyance facilities, like the treatment plant, would be designed in accordance with all applicable Ecology and UFC requirements, which include rigorous standards for spill prevention and containment. Areas used for loading and unloading materials would include similar spill containment features.

Comments on the Draft EIS questioned the safety of force mains in comparison with gravity pipelines. Force mains are included in the Unocal system alternative. In terms of safety considerations, the major differences between force mains and gravity lines entail pressure in the pipelines. Rupturing of a force main could result in the release of influent or effluent under pressure, temporarily exposing individuals to untreated or treated wastewater until the rupture could be addressed. Rupture could occur from breaks in the pipelines caused by cracks or weak spots in pipelines or from inadvertent rupture during excavation activities. The potential for ruptures is very low, because force mains would be designed to withstand operating and transient pressures in accordance with American Water Works Association design criteria and Ecology's Criteria for Sewage Works Design. Pipelines would be pressure tested for a minimum of 50 percent over the design working pressure or maximum transient conditions plus a safety factor, whichever is greater. Potential environmental health impacts from rupture of force mains located within tunnels would be minimal because releases would be contained in the tunnel.

The relationship of proposed conveyance facilities to groundwater, including drinking water supplies, is discussed under each system alternative, below. Also refer to Chapter 6 and Appendix 6B, Geology and Groundwater, for more information.

Liquid phase odor control for all alternatives would include sodium hypochlorite, calcium nitrate, and iron salts. Facilities for both conveyance corridors would contain storage tanks with a volume of about 5,000 gallons containing sodium bisulfite for dechlorination. Vapor phase treatment, which could consist of chemical scrubbers along with biofiltration, bioscrubbers, or activated carbon, would be located in the Kenmore and North Creek areas for all alternatives. Chemical injection facilities for odor control would contain a two-week supply of chemicals. Storage facilities would be designed in accordance with UFC requirements for spill containment. Security would be provided around buildings to restrict public entry. There have been no documented incidents of chemical spills at King County conveyance facilities that resulted in any danger to individuals outside of the facility boundaries.

Hazardous Gases in the Wastewater System

Hazardous gases could emanate from the conveyance system, particularly if maintenance techniques temporarily malfunction or are not effective. Current wastewater design criteria incorporate facility design provisions to minimize this potential (Ecology, 1998). As a result, explosions in recently constructed conveyance systems are extremely rare. There has never been an explosion within a King County treatment or conveyance system (Cox, personal communication, 2002). Special provisions to prevent gas buildup, such as ventilation shafts with odor control, would be implemented because of the anticipated depths of tunnels and access facilities. Pipelines and pump stations would also be routinely inspected and monitored for hazardous gases.

Although hydrogen sulfide poses a health risk at high concentrations, there is a very low potential for public exposure at lower levels. Nontoxic exposure could occur from manholes or vents in the conveyance system; however, these releases are not common. Conveyance facility design would include measures to minimize hydrogen sulfide

production as well as potential public health implications. All facilities such as pump stations would be equipped with meters to monitor hydrogen sulfide. Manholes and pipelines would be manually opened or entered on a routine basis and inspected and monitored for hydrogen sulfide.

Similarly, the conveyance system would be designed to minimize the production of methane. Conveyance lines would incorporate venting facilities in areas that may be prone to potential buildup of gases. As with the treatment plant, conveyance facilities would be subject to compliance with the UFC and would require permits from local fire departments.

Emergency Overflows

As previously discussed, emergency overflows could occur at a discharge point in the Sammamish River.

9.3.2.3 Outfall Impacts Common to All Systems

Construction Impacts Common to All Systems: Outfall

Construction impacts to environmental health would be similar for the two outfall zones considered. Spills and leaks of hydraulic fluid or petroleum products from offshore equipment could wash onshore, creating potential health risks for waders and swimmers. All in-water construction would be subject to spill containment requirements designed to prevent contaminants from spreading; however, some small quantities could be released. Testing has indicated that surface sediments along both proposed outfall alignments meet all applicable sediment quality standards; therefore, potential health risks associated with surface sediment disruption are considered negligible. The potential to encounter contaminated sediments in the vicinity of Point Wells is discussed under the Route 9 system, below. It is possible that contaminated sediments may be encountered at depths deeper than those monitored. Should this occur, all appropriate laws and regulations would be followed to minimize contaminant release to the environment and the potential for human health effects.

Operation Impacts Common to All Systems: Outfall

Given the depth and distance of the treated effluent discharge point and mixing that would occur in both outfall zones, it is unlikely there would be any human contact with treated effluent. At both outfall locations, the outfall would be approximately 600 feet deep and at least 4,700 feet offshore, minimizing the potential for humans to come in contact with constituents of concern at harmful levels. In addition, with the selection of membrane bioreactor (MBR) technology since issuance of the Draft EIS, effluent quality is expected to be as good as or better than conventional activated sludge (CAS) technology (refer to Appendix 6-I; Effluent Quality Evaluation for the Membrane

Reactor and Advanced Primary System). The potential impacts associated with the contaminants of concern from marine discharges are discussed below. Chapter 6 provides more detailed information about effluent quality and potential water quality impacts.

Bacteria, Viruses, and Other Pathogens

Effluent treated at the Brightwater treatment plant would be subject to some of the most advanced primary and secondary treatment methods available to remove contaminants of concern. Brightwater is being designed to meet applicable water quality standards intended to be protective of aquatic life and human health (WAC 173-201A). As described in Chapter 6, once effluent from the outfall reaches the edge of the chronic mixing zone, the concentration of contaminants of concern would be diluted to concentrations that meet or exceed state and federal water quality standards intended to protect public health. Additionally, the outfall diffuser in both outfall zones is being designed to maintain the discharge plume well below shellfish beds in the project area under most oceanographic conditions.

King County analyzed whether or not people could be exposed to bacteria, viruses, and other pathogens in treated effluent from the Brightwater plant in the unlikely event that organisms were to survive and were transported from the treated effluent to the water surface. Following transport to the water surface, the studies examined whether or not people could be exposed if they come into contact with the water while swimming or wading, through contact with or ingestion of receiving water, or through other activities such as windsailing or SCUBA diving. King County also evaluated people who harvest and consume fish and shellfish that may potentially be exposed to pathogens that accumulate in these organisms.

Bacteria, viruses, and pathogen levels from discharges in both outfall zones are predicted to be lower than those that have been deemed safe for water contact and for harvesting shellfish and fish (Parametrix and Intertox, 2002). This evaluation estimated the level of indicator fecal coliform organisms in treated effluent, evaluated the amount of dilution the treated effluent achieved in Puget Sound, and estimated the potential for human exposure at various beaches and in the open waters of the Sound.

Overall, Brightwater would not impact shellfishing activities because the project area waters are closed to commercial shellfishing, and recreational shellfishing is not recommended. If other sources of pollution into Puget Sound are reduced in the future to levels that would allow the opening of King and Snohomish County beaches for commercial shellfish harvesting, the effluent discharged from the Brightwater treatment plant would not preclude the opening of these beaches.

Nutrients

Nutrients are not a direct human health risk factor in marine waters. However, concerns have been expressed by some scientists that increased levels of nutrients could contribute to the production of algae that is harmful to humans.

As noted in Chapter 6, Brightwater effluent would introduce nutrients in the form of nitrogen and phosphorus into the Central Basin of Puget Sound. As noted in Chapter 7, as algae use nitrogen in the spring and summer blooms, the nitrogen levels decrease to a point where the algae levels crash. Modeling conducted by King County for the Brightwater project (West Consultants and King County, 2002) has predicted that during late spring and summer, when density stratification in Puget Sound is most pronounced and phytoplankton production is high, the trapping layer would remain at depths greater than the depth of the euphotic zone (the upper water layer where light penetrates and photosynthesis occurs). This implies that during the growth season phytoplankton exposure to effluent would be limited to the steady-state concentrations that would be present in the bulk of the Main Basin.

During times of the year when the water column is not stratified the trapping layer would rise and may approach the sea surface. Under these conditions the mixing layer may penetrate the euphotic zone. However, because an unstratified water column typically only occurs during the winter when phytoplankton production is negligible, the effluent present in the mixing layer should not affect phytoplankton production during this time.

Overall, nitrogen in treated effluent from Brightwater is not predicted to result in a measurable change in nitrogen levels in Puget Sound (Parametrix and Intertox, 2002). As a result, it is unlikely that there would be a measurable change in algae levels inhabiting the water column. Exceptions could occur during early spring, when algal populations are experiencing a growth burst and density stratification is still in development. In response to comments on the Draft EIS, a more detailed assessment was conducted on the potential influence of Brightwater discharges on harmful algal blooms in Puget Sound (see Appendix 7-D, Assessment of Potential Influence of Brightwater Discharges on Harmful Algal Blooms in Puget Sound). Based on this thorough evaluation, it is not possible at this time to predict which algal species, harmful or not, would be able to effectively use any small increase in available nutrients for cell division and growth.

Metals and Organic Chemicals

The potential for metals and organic chemicals in treated effluent from Brightwater to impact human health was examined by King County (Parametrix and Intertox, 2002). This evaluation examined several factors:

- How people may be exposed to the chemicals in the treated effluent
- The level of exposure to the chemicals in the treated effluent
- The potential for increased cancer risk associated with exposure to chemicals in the treated effluent
- The potential for non-cancer effects associated with exposure to chemicals in the treated effluent

People may be exposed to chemicals discharged from the Brightwater outfall through contact with or consumption of seafood from Puget Sound in the vicinity of the outfall

zones. Examination of the recreational patterns of people in the vicinity of the outfall zones shows that people swim, wade, SCUBA dive, or consume fish and seafood from these areas, especially in Zone 6 (Parametrix, 2001; Parametrix and Intertox, 2002). Thus, there is a potential for exposure to chemicals or pathogens from the effluent.

Since issuance of the Draft EIS, additional evaluations have also been conducted to compare effluent quality and potential health implications from MBR-treated effluent and to verify previous findings (see Appendix 6-I, Effluent Quality Evaluation for the Membrane Bioreactor and Advance Primary System). Side-by-side comparisons of MBR and CAS effluents were conducted for 12 chemicals for which sufficient data are available: aluminum, barium, chromium, copper, mercury, nickel, silver, zinc, ammonia-nitrogen, bis(2-ethylhexyl)phthalate, di-N-butyl phthalate and phenol. In all cases, MBR effluent quality was as good as or better than CAS effluent quality. Blended MBR-Advanced Primary Treatment (APT) effluents were also compared to CAS effluent under a range of flow conditions. The analysis confirmed that blended effluent quality would be as good as or better than CAS effluent quality. In no case, even at high flow rates, did effluent quality change significantly enough to change the conclusions of the water quality investigations conducted in support of the Draft EIS.

For the Final EIS, subsistence shellfish diets were evaluated, along with the finfish and finfish-shellfish diets evaluated for the Draft EIS, to determine both cancer and non-cancer hazard quotients. Shellfish ingestion rates were collected from surveys conducted by the Suquamish Tribe. The parameter contributing most to both the cancer risks and non-cancer hazard quotients is arsenic, with bis (2-ethylhexyl) phthalate contributing the second most. The cancer risk estimates are within the National Contingency Plan (NCP) range the EPA generally considers acceptable when characterizing the magnitude of risks related to Superfund sites.

As was reported in the Draft EIS, cumulative cancer risks and non-cancer hazard quotients for all scenarios (both ambient and future) were determined to be no greater than those posed by current ambient conditions in Puget Sound. Exposures to chemicals that may cause cancer will result in cancer risks of no greater than one-in-one-million (Parametrix and Intertox, 2002). As an interpretation, if one million people were exposed at the predicted levels, less than one additional cancer would be expected over a lifetime than would otherwise occur. Currently, about one-in-three to one-in-four people develop cancer over the course of their lifetime. These findings suggest that there would likely be no impact on human health from exposures to chemicals in the treated effluent.

9.3.2.4 Proposed Mitigation Common to All Systems

Treatment plant, conveyance, and outfall facilities would be designed and constructed in accordance with stringent health and safety requirements. All facilities would be constructed in accordance with Ecology's *Criteria for Sewage Works Design* (Ecology, 1998).

The *Criteria for Sewage Works Design* serves as a guide for the design of domestic wastewater collection and treatment. The manual identifies several goals:

- To ensure that the design of wastewater collection and treatment systems is consistent with public health and water quality objectives of the State of Washington
- To establish a basis for the design and review of plans and specifications for wastewater treatment works and wastewater collection systems
- To establish the minimum requirements and limiting factors utilized by Ecology and Washington State Department of Health for review of wastewater treatment works and wastewater collection system plans and specifications
- To assist the owner or their authorized engineer in the preparation of plans, specifications, reports, and other data
- To guide departments in their determination of whether an approval, permit, and/or a certificate for wastewater treatment works or a wastewater collection system should be issued

Compliance with Ecology requirements would minimize the potential for environmental health impacts.

All treatment plant and conveyance facility design and construction would comply with applicable requirements of the UFC and local building codes in place at the time of application for building permits. The purpose of the UFC is to ensure that construction and maintenance of structures protects public health and safety. The UFC includes provisions for fire department access, fire hydrants, automatic sprinkler systems, fire and explosion hazards safety, hazardous materials storage and use, protection and assistance to first responders, and other safety and public health considerations.

Spills, Leaks, and Other Emergencies

- During treatment plant, conveyance, and outfall construction, King County will require contractors to prepare and follow hazardous spill prevention plans and hazardous waste contingency plans. Spill containment provisions will be developed and response kits provided. These measures will be identified and described in a detailed Spill Prevention, Containment, and Control Plan (SPCCP) to be developed prior to construction. Spill prevention and cleanup provisions will comply with the Ecology 2001 Stormwater Management Manual for Western Washington. With King County oversight, a Site Specific Health and Safety Plan would be developed by contractors to address emergency response and potential hazards on construction sites. Refer to the Impacts and Mitigation section of Chapter 6 for a description of best management practices that would be implemented at all construction sites.

- During construction, treatment plant underdrain systems will include leak detection below the water-holding basins. Pressure testing and construction QA/QC will also help reduce the risk of leaks.
- The stormwater collection system within the treatment plant will be designed to capture spills from chemical use and delivery areas and route them to the treatment plant instead of an offsite receiving water.
- Conveyance lines would be designed in accordance with Ecology design criteria, which would minimize the potential for hazardous gas buildup. Conveyance lines would be monitored for potentially harmful gases prior to regular inspections; any potentially hazardous gas buildups would be reduced by introduction of oxygen or other chemicals, and steps immediately taken to reduce future buildup of these materials.
- During treatment plant operation, spill prevention measures such as leak detection systems, secondary containment, drainage retention, and regular inspection and maintenance will be developed consistent with the UFC, RCRA, OSHA, and other applicable regulations. Storage tanks will be designed with double walls, spill containment berms, alarms, level indicators, ventilation, and other features to minimize spill risks and impacts.
- Portal shafts would be sealed to minimize risks from fuel or chemical spills. During construction of the outfall, all in-water construction would be subject to spill containment requirements.
- Force mains would be designed to withstand operating and transient pressures in accordance with American Water Works Association design criteria and Ecology's Criteria for Sewage Works Design. Pipelines would be pressure tested for a minimum of 50 percent over the design working pressure or maximum transient conditions plus a safety factor, whichever is greater.
- Aerosols and other potential airborne contaminants, including VOCs, would be contained onsite by capturing or cleaning areas of the treatment plant that could release these contaminants. Liquids processing areas where aerosols are generated, such as headworks, primary clarifiers, and aeration basins, would be covered and contained, and air treated prior to discharge. All air emissions from the site would be in compliance with air quality standards. (Refer to Chapter 5 for a discussion of design features to minimize the potential release of odors and other airborne constituents.)
- King County would develop security and emergency response measures and protocols for the treatment plant and conveyance facilities to protect against unauthorized entry. These measures could include restricted access, fencing, controlled visitor access, security cameras, security staffing, and lockdowns. An Emergency Response Plan would also be developed specifically for the Brightwater plant to outline procedures to address fires, medical emergencies, power outages, and other similar incidents.

- King County would continue to work with local emergency service providers, including fire and utility districts, to develop emergency response plans and address response needs through appropriate staffing, equipment, and other resources.

Hazardous Materials

- Contaminated soils and sediments would be handled in accordance with MTCA and Washington State Sediment Management Standards (SMS) administered by Ecology. Compliance with MTCA and SMS would reduce the potential for exposure to contaminated soils and would require approved disposal. Site cleanup, if required, would be conducted in accordance with MTCA and SMS requirements.
- All construction sites, including those with contaminated soils, would be fenced to prevent public access.
- Groundwater from construction sites would be tested for contamination. Contaminated groundwater would be properly disposed of, either through onsite treatment or hauling to an approved offsite disposal facility.
- Prior to demolition, any materials containing asbestos or lead would be removed in accordance with WISHA requirements by a licensed abatement company.
- As noted above, storage of all hazardous materials at treatment or conveyance facilities requires a permit from local fire departments, and compliance with all applicable requirements of the UFC, RCRA, and OSHA.

Emergency Overflows

- King County has developed a five-part emergency flow management system for both the Unocal and Route 9 systems: (1) diverting flows to the West Point and South Treatment Plants, (2) diverting excess flows into the existing Logboom and North Creek Storage Facilities, (3) storing flows in new and existing conveyance pipelines, (4) using emergency generators to keep new and existing pumping stations operational in the event of power outages, and (5) as a last resort, diverting partially treated wastewater through the effluent system and outfall to Puget Sound.

Emergency overflows would occur at the safety relief point in the Sammamish River in Kenmore only if the five strategies do not reduce flows through the conveyance system to manageable levels.

- Following an overflow event, the Seattle/King County Health Department would coordinate with Snohomish County Health Department to install temporary warning signs or provide other methods of notification in affected areas. These departments would consult with one another regarding appropriate cleanup measures, including debris removal if necessary. King County would conduct

water quality monitoring until conditions returned to background levels. In addition, Ecology would be notified within 24 hours of the emergency overflow.

Discharges to the Marine Environment

- The Brightwater Treatment Plant would use state-of-the-art MBR technology. King County has achieved a high level of treatment efficiency at its West Point and South Treatment Plants and intends to meet or exceed its performance record at Brightwater. Effluent would be treated to comply with all applicable water quality standards and with Ecology's NPDES requirements. These standards and requirements are designed to protect human health and the environment. In addition, the outfall would be located in deep water at the "Triple Junction" in Puget Sound where currents would effectively disperse effluent to minimize the potential for human contact. Implementation of the Brightwater Treatment Plant would be a long-term measure to protect environmental health in the Puget Sound region.
- Marine water and sediment quality monitoring programs would continue and would comply with all discharge permit requirements (see Appendix 3-I, Proposed Routine Monitoring Plan for the Receiving Environment in the Vicinity of the Brightwater Treatment System Marine Outfall). Effluent discharged from the treatment plant would be monitored as required by the Brightwater NPDES permit, which would require compliance with all applicable Water Quality Standards. As part of compliance with its NPDES permit, King County would submit monthly monitoring reports to Ecology regarding compliance with the permit's effluent limitations. It is also anticipated that King County would conduct periodic visual inspections of the outfall every 2 to 5 years to verify that it is operating correctly. The County would respond to any new scientific information emerging from ongoing or future scientific research programs examining the potential role of secondary treated effluents in influencing environmental health factors.

9.3.3 Impacts and Mitigation: Route 9 System

9.3.3.1 Treatment Plant: Route 9

Construction Impacts: Route 9 Treatment Plant

Potential construction impacts at the Route 9 site are similar to those described above in the section titled Impacts and Mitigation Common to All Systems. It is anticipated that contaminated soil or groundwater is present at the site, which would be confirmed by onsite testing. Site soil and groundwater may be contaminated as the result of past and current industrial uses. One property on the site is on Ecology's Model Toxics Control

Act (MTCA) list of suspected and confirmed contamination sites, as of May 2001. It has been ranked as a 5, the lowest level of risk, and it is awaiting remedial action.

For purposes of this EIS, it is assumed that some soil and groundwater contamination would be encountered during the large-scale excavation required for construction of the Brightwater plant. Site-specific investigations would be conducted during predesign and final design to confirm the presence of contamination. Should contamination be identified, cleanup activities would be implemented in accordance with Ecology requirements. No significant environmental health impacts are anticipated.

Because groundwater flows from east to west across the Route 9 site, regional public drinking water supply wells, including the Cross Valley Water District's Woodlane Well, which is east and approximately 3,000 feet upgradient of the site, would not be impacted by any potential spills during construction. The District's other nine wells are also located upgradient of the site, and the Route 9 site itself is outside of the District's designated wellhead protection area. Refer to Appendix 6-B, Geology and Groundwater, for more information relating to groundwater flows.

Operation Impacts: Route 9 Treatment Plant

Materials Stored and Used at the Treatment Plant Site

All hazardous materials stored and used at the Route 9 site would be subject to permitting requirements from the Snohomish County Fire Protection District No. 7. Appendix 3-A, Project Description: Treatment Plant, provides a list of the types and quantities of chemicals that would be used at the Route 9 site. Impacts are the same as described under Impacts and Mitigation Common to All Alternatives.

Spills, Leaks, and Other Releases

As described earlier, spills or leaks of potentially hazardous materials could occur at the Route 9 site. Most of these materials are fuels used for equipment and vehicles at the site. Any spills that occur onsite would be contained. In the unlikely event that a spill exceeded site spill containment capacity, it would be routed to the treatment plant for treatment. There would be minimal potential for discharge of spilled materials to Little Bear Creek or to domestic groundwater supplies, which lie upgradient of the site.

As described above, groundwater flows from east to west across the Route 9 site and regional public drinking water supply wells, including the Cross Valley Water District's Woodlane Well, are east and approximately 3,000 feet upgradient of the site. The District's other nine wells are also located upgradient of the site and would not be impacted in the unlikely event of spills or leaks during plant operation.

Emergency Overflows

As described above under Impacts and Mitigation Common to All Systems, the Brightwater Treatment Plant would reduce the potential for wastewater overflows.

However, under extreme conditions, overflows to a safety relief point in the Sammamish River could occur.

The Route 9 site would also have the ability to temporarily route untreated effluent around the facility in the case of a localized plant emergency if both primary and secondary power feeds are de-energized, the treatment plant is operating on standby power, previous flow management strategies have been fully utilized, and an overflow is still imminent. In such instances, influent would be temporarily conveyed in a bypass around the plant to the effluent tunnel and combined with treated effluent until the problem could be corrected. Up to 170 mgd of diluted untreated or partially treated wastewater could bypass the treatment processes at the plant site and flow into the effluent conveyance system for eventual discharge into Puget Sound. the goal of this strategy is to force the overflow to occur at a deep water, offshore outfall in a highly mixed marine environment rather than into an urban freshwater body, thereby reducing the potential human health impacts of such an event. This would minimize the potential of local spills of untreated effluent and further minimize environmental health concerns.

Proposed Mitigation: Route 9 Treatment Plant

Mitigation measures are described above under Impacts and Mitigation Common to All Systems. No site-specific mitigation is being considered beyond those measures described above.

9.3.3.2 Conveyance: Route 9

Route 9–195th Street Corridor

Construction Impacts: Route 9–195th Street Corridor

The construction-related risks to environmental health at all primary and secondary portals along the Route 9–195th Street corridor are similar to the risks described for conveyance under Impacts and Mitigation Common to All Systems. The 195th Street corridor would include 15.9 miles of conveyance, including 8.1 miles of influent line and local connections to the existing system. Because the Route 9 conveyance corridors are longer than the Unocal corridor, construction-related risks could be higher. Overall risks to environmental health from conveyance facility construction are considered to be low, given safety and health precautions that would be implemented, as described below under Proposed Mitigation.

The Route 9–195th Street corridor passes 4,000 feet to the south of the Olympic View Water District's Deer Creek Spring and would be constructed 200 feet below the spring in underlying aquifers and aquitards. This location would provide separation between the tunnel and the spring, and there would be little potential for impacts to drinking water

supply during construction. Similarly, Portal 19 is located downgradient of the spring. Portal 5 is more than 3 miles southeast of Deer Creek. No impacts to drinking water quality are anticipated.

It is unlikely that construction of the Route 9–195th Street corridor would impact drinking water quality in the Lake Forest Park Water District wellfield due to inward pressures on the tunnel, preventing outflow. Further geotechnical investigations are underway to identify additional measures to ensure protection of the wellfield.

Similar to the Route 9 treatment plant site, the Route 9–195th Street conveyance corridor would be located downgradient of the Cross Valley Water District’s nearest drinking water well. No adverse environmental impacts are anticipated.

Contaminated soils and groundwater may be encountered during construction at Portal 19. The site is within the ChevronTexaco property, which contains documented amounts of soils and groundwater contaminated with petroleum products. Contaminants attached to soil particles could become airborne as volatile organic compounds (VOCs). The greatest risk of exposure to contaminants would be to construction workers at the site, associated with inhaling dust particles. All site work involving contaminated soils would be conducted in compliance with the MTCA administered by Ecology; site work with contaminated soil requires special training and monitoring under OSHA/WISHA regulations. All construction areas would be fenced to prevent access by the public. Refer to Chapter 4 for more information on earth-related impacts, and to Chapter 5 for more discussion of VOCs.

Portal 41 Influent Pump Station Option

Environmental health impacts related to construction of the IPS at Portal 41 are similar to those identified for portal construction and include potential for spills or leaks. However, because of the increased level of construction activity at the site, there would be an attendant higher risk for spills or other leaks of fossil fuel-based materials due to the increased number of trucks and construction equipment. As indicated in earlier discussions, policies and procedures would be implemented to ensure minimal impact to environmental health during construction.

The Portal 41 IPS option presents safety benefits during construction because it reduces the depth of shaft construction. An IPS at Route 9 requires deeper shaft construction; reduction in shaft depth at Portal 41 would reduce potential risks associated with the deeper shaft.

Operation Impacts: Route 9–195th Street Corridor

At Route 9, effluent would be disinfected with sodium hypochlorite in the effluent tunnel. There would be an influent pump station at the Route 9 site, and a dechlorination facility would be required at Portal 5. Chemicals may be used for odor control at Portals 11, 41, and 44. As previously discussed, facilities would be designed with spill and leak containment measures and storage tanks to minimize the risk of spills.

As mentioned above, the Route 9–195th Street corridor passes 4,000 feet to the south of the Olympic View Water District’s Deer Creek Spring complex and would be located 200 feet below the complex in underlying aquifers and aquitards. No impacts to drinking water supply are anticipated.

Portal 41 Influent Pump Station Option

Operational impacts associated with the IPS include the potential for spills and leaks or other releases to the environment. Onsite storage of oxidizing chemicals for odor control such as hydrogen peroxide and sodium hypochlorite would be required. The IPS, like other Brightwater facilities, would be designed in accordance with all applicable Ecology and UFC requirements, which include rigorous standards for spill prevention and containment. Security would be provided around the buildings to restrict public entry. To prevent build-up of hazardous gases, the pump station would include routine inspection and monitoring for hydrogen gases, and would be equipped with meters to monitor hydrogen sulfide.

Because of reduced in-line storage associated with this option, the risk of discharge from the safety relief point would increase under this option, as compared with the proposed project. While the potential for discharge is still very low, the frequency could increase to as much as one event every 50-75 years. This increased risk still represents a significant improvement over existing discharge frequencies.

Proposed Mitigation: Route 9–195th Street Corridor

As described above, construction and operation of conveyance facilities would comply with all applicable requirements by Ecology and local fire departments to reduce potential environmental health risks to levels considered acceptable by state and local officials. There are no additional environmental health mitigation measures specific to the 195th Street conveyance corridor.

Route 9–228th Street Corridor

Construction Impacts: Route 9–228th Street Corridor

Construction impacts for the Route 9–228th conveyance corridor, including all primary and secondary portals, are generally similar to those described above for Impacts and Mitigation Common to All Systems. This conveyance alternative would include 20.3 miles of conveyance, including 8.1 miles of influent line and local connections to the existing system. Overall risks to environmental health from the 228th conveyance facility construction are considered to be low, given safety and health precautions that would be implemented.

Similar to the Route 9–195th Street corridor, the Route 9–228th Street corridor, though within the wellhead protection area of the Olympic View Water and Sewer District’s Deer Creek Springs, would be constructed 200 feet below the Springs in underlying aquifers and aquitards. This location would provide separation between the tunnel and the Springs, and there would be little potential for impacts to this drinking water source. Portal 19 is downgradient of the complex as described above, while Portal 26 is 12,000 feet from the complex and outside of the wellhead protection zone. In addition, the analysis described in Chapter 6 indicates drawdowns at the 228th Street well caused by tunnel construction would be within the ranges described previously, i.e., generally less than 1 foot in the Qva Aquifer and less than 26 feet in the Qu Aquifer. Drawdowns associated with a face inflow event would be greater, if this unlikely event were to occur in the immediate vicinity of the well.

No construction impacts to the Lake Forest Park Water District wellfield are anticipated. This corridor is approximately 11,000 feet from the wellfield at its closest point.

Similar to the Route 9 treatment plant site, the Route 9–228th Street conveyance corridor would be located downgradient of the Cross Valley Water District’s nearest drinking water well. No adverse environmental impacts are anticipated.

Potential impacts from encountering VOCs from contaminated soils and groundwater at Portal 19 would be the same as those described under the Route 9–195th Street corridor above.

Operation Impacts: 228th Street Corridor

Operation impacts for the Route 9–228th conveyance corridor are generally similar to those described above for Impacts and Mitigation Common to All Systems. Overall risks to environmental health from operation of the 228th conveyance facility are considered to be low, given safety and health precautions that would be implemented, as described below under Proposed Mitigation.

There would be a dechlorination facility at Portal 26. Chemical odor control may be provided at Portals 11, 41, and 44. As previously discussed, facilities would be designed with spill and leak containment measures and storage tanks to minimize the risk of spills.

As mentioned above, the Route 9–228th Street corridor passes well below the Olympic View Water District’s Deer Creek Spring complex in underlying aquifers and aquitards. No impacts to drinking water supply from operation are anticipated.

No operation impacts to the Lake Forest Park Water District wellfield are anticipated. This corridor is approximately 11,000 feet from the wellfield at its closest point.

Portal 41 Influent Pump Station Option

The impacts associated with the Route 9–228th Street Corridor IPS option are the same as those described for the Route 9–195th Street Corridor Portal 41 IPS option described above.

Proposed Mitigation: 228th Street Corridor

Ground freezing, as described in Chapter 6 and in Appendix 6-B, Geology and Groundwater, would be used at Portal 26 to minimize potential interconnection of aquifers. Special studies and construction methods would be conducted and applied as needed to protect the 228th Street well of Olympic View Water District. If required, additional mitigation would be developed to protect this wellfield. Other mitigation measures would be the same as described above for the 195th Street conveyance corridor. There are no additional environmental health mitigation measures specific to the 228th Street conveyance corridor.

9.3.3.3 Outfall: Route 9**Construction Impacts: Route 9 Outfall**

Construction impacts are the same as those described above for Impacts and Mitigation Common to All Systems. There are no site-specific construction impacts associated with the Route 9 System outfall.

Operation Impacts: Route 9 Outfall

Operation impacts are the same as those described above for Impacts and Mitigation Common to All Systems. There are no site-specific operation impacts associated with the Route 9 System outfall.

Proposed Mitigation: Route 9 Outfall

Brightwater discharges of treated effluent to Puget Sound would pose no significant risk to public health. As described above for Impact and Mitigation Common to All Systems, King County would monitor effluent quality to ensure that the Brightwater plant operates as designed and that the effluent discharged to Puget Sound meets all NPDES permit requirements.

9.3.4 Impacts and Mitigation: Unocal System

9.3.4.1 Treatment Plant: Unocal

Construction Impacts: Unocal Treatment Plant

Construction impacts at the Unocal site are largely the same as those described for the Route 9 site. However, the Unocal site has confirmed soil and groundwater contamination originating from 70 years of industrial activities. Unocal is conducting investigation and cleanup of contamination under an order from the Washington State Department of Ecology. Remediation would be conducted in accordance with an approved plan from Ecology. Following completion of site remediation, there would be only a minimal risk to construction workers from contamination. Additional information on site contamination is included in Chapter 4. Mitigation measures in Chapters 4 and 5 describe methods to minimize transport of VOCs in dust and sediment offsite, reducing the potential impacts from airborne transport of particulates on surrounding residents and other individuals during construction.

If inappropriately conducted, dewatering from construction could spread contamination across the site. This would require proper offsite disposal. All domestic water supply wells are, however, upgradient and would not be affected during construction or operation.

Operation Impacts: Unocal Treatment Plant

Materials potentially stored and used at the Unocal treatment plant site are described above under Impacts and Mitigation Common to All Systems. All hazardous materials stored and used at the site would be subject to permitting requirements from the Edmonds Fire Department.

Under emergency conditions described below, emergency overflows of influent from the Unocal treatment plant would discharge either through the safety relief point in Kenmore or through a separate safety relief outfall at the treatment plant into Puget Sound. The Unocal conveyance tunnel has been designed to provide the same volume of available storage as the Route 9 tunnel.

The Unocal treatment plant system would have the final option of discharging an unavoidable overflow into Puget Sound by allowing influent to bypass the treatment plant. The conditions for such a Unocal plant bypass would be if both primary and secondary power feeds are de-energized, the treatment plant is operating on standby power, the previous four flow management strategies have been fully utilized, and the proposed pump station at Portal 11 is still operational. The maximum flow that could be bypassed to prevent an overflow into the Sammamish River would be limited by the capacity of the new Portal 11 pump station. A temporary overflow into the deep outfall in

Puget Sound is unlikely to pose significant environmental health risks due to the deepwater discharge point and dilution achieved at this point, along with the temporary nature of the overflow event.

Proposed Mitigation: Unocal Treatment Plant

Mitigation measures are described above under Impact and Mitigation Common to All Systems. No other site-specific mitigation is being considered beyond those measures described above.

9.3.4.2 Conveyance: Unocal

Construction Impacts: Unocal Conveyance

Similar to the Route 9 corridors, the Unocal corridor, though within the wellhead protection area of the Olympic View Water and Sewer District's Deer Creek Spring, would be constructed approximately 125 feet below the Springs in underlying aquifers and aquitards. This location would provide separation between the tunnel and the spring, and there would be little potential for impacts to this drinking water supply. Potential impacts from constructing Portal 3, while located approximately 4,000 feet upgradient from the spring, would be minimized through the use of ground freezing to prevent groundwater movement into or out of the portal excavation.

The Unocal corridor passes about 2,200 feet south and southwest of the Lake Forest Park Water District Wellfield. This location is downgradient or cross gradient from the wellfield; therefore, impacts to this drinking water supply are not anticipated.

Other than the construction impacts described above, no additional site-specific risks exist for the Unocal corridor.

Operation Impacts: Unocal Conveyance

The conveyance system for Unocal would convey untreated wastewater along its entire length of approximately 11.6 miles.

Permanent facilities would include chemical odor control at Portal 14, Portal 11, and Portal 7, as well as a new pump station at Portal 11. As previously discussed, facilities would be designed with spill and leak containment measures and storage tanks to minimize the risk of spills.

Proposed Mitigation: Unocal Conveyance

For construction of Portal 3, ground freezing would be used to minimize potential impacts to the Deer Creek Springs water supply. Refer to Impacts and Mitigation Common to All Systems, above, for a discussion of impacts associated with ground freezing.

As described above, construction and operation of conveyance facilities would comply with all applicable requirements by Ecology and local fire departments to reduce potential environmental health risks to levels considered acceptable by state and local officials.

9.3.4.3 Outfall: Unocal**Construction Impacts: Unocal Outfall**

Construction impacts are the same as those described above for Impacts and Mitigation Common to All Systems. There are no site-specific construction impacts associated with the Unocal system outfall.

Operation Impacts: Unocal Outfall

Operation impacts are the same as those described above for Impacts and Mitigation Common to All Systems. There are no site-specific operation impacts associated with the Unocal system outfall.

Proposed Mitigation: Unocal Outfall

Mitigation measures would be as described above for Impacts and Mitigation Common to All Systems and for the Route 9 System. No site-specific mitigation is being considered beyond those measures described above.

9.3.5 No Action Alternative

Under the No Action Alternative, overflows that discharge untreated wastewater to Lake Washington and the Sammamish River, as well as other surface water systems, would increase as population in the region increases and the capacity of the existing wastewater system is exceeded. Wastewater flow increases that accompany the growing regional population would be routed to existing wastewater treatment plants and onsite disposal systems, including individual and group septic systems. As described in King County's 1998 Regional Wastewater Services Plan and Appendix 3-J, Evaluation of the No Action

Alternative, existing King County wastewater treatment plants are nearing capacity and would be unable to accommodate increased flows by 2010. This could result in increased overflows within the existing wastewater treatment system, including increased discharges of untreated wastewater into area streams, rivers, and lakes. The discharge of additional untreated wastewater would have a potentially adverse impact on the quality of these water resources by increasing concentrations of bacteria, nutrients, and toxicants, and decreasing concentrations of dissolved oxygen. These impacts would extend beyond the emergency overflow period because of pollutants retained in sediments.

To evaluate the potential for increased overflows under the No Action Alternative, the wastewater system was modeled using large extended rainfall events and population and employment forecasts to estimate peak flows and storage/overflows at various points in the system. Under the No Action Alternative, overflows in the Brightwater service area are not expected during a 20-year peak flow event (5 percent chance of occurring in any given year) through the year 2010. The increase in flows until 2010 would be directed to the South Treatment Plant via the East Side Interceptor.

Beyond 2010, as flows in the system increase the volume of untreated wastewater overflow, corresponding environmental health risks would also increase. Probabilities of overflows to the Sammamish River in the vicinity of Kenmore would increase from one event per every 20 years in 2010 to once per year in 2020. Overflow volumes to the Sammamish River in a 20-year peak flow event in 2020 would be approximately 60 million gallons of untreated wastewater, with an average annual overflow volume of 20 million gallons. This increase in the frequency and volume of overflows would increase the potential for human contact and environmental health risks.

Beyond 2020, the No Action Alternative would result in system-wide wastewater capacity shortages, reduced efficiency at existing wastewater treatment plants, lower quality effluent from the County's South and West Point Treatment Plants, and the continued and increased potential for septic system failures as capacity would not be available for wastewater service hookups.

If the Brightwater System is not developed, wastewater flows would continue to flow south via the East Side Interceptor to the South Treatment Plant. Overflows to Lake Washington would be possible at various points along the Interceptor and would have a 30 percent chance of occurring in any particular year. This increase would correspondingly increase environmental health risks for individuals swimming, boating, or otherwise recreating in or along the east shore of Lake Washington.

Without Brightwater, the South Treatment Plant is estimated to reach its capacity of 115 mgd average wet-weather flow by 2010. Flows above the treatment plant secondary capacity would not receive secondary treatment. These flows would be conveyed through the outfall, mixed with secondary treatment plant effluent. Wastewater flows at the South Treatment Plant above 325 mgd may exceed the capacity of the effluent pump station. Under these emergency conditions, some secondary treated effluent may be discharged into the Green River, increasing environmental health risks from water contact recreation.

The West Point Treatment Plant may have additional hydraulic capacity, but not the solids handling capacity, to treat additional peak flows. However, the limited conveyance capacity of the Kenmore Interceptor Lake Line restricts the flow that can be sent from northern King County and southern Snohomish County to the treatment plant. Attempts to increase flows to the West Point Treatment Plant would result in the previously described overflows into the Sammamish River and Lake Washington from the Kenmore Interceptor.

Overall under the No Action Alternative, the contaminants that are now controlled and largely removed through the treatment process would be more frequently released untreated to the environment, exposing people to a greater potential for illness from wastewater-borne pathogens and other components. This would result in more violations of water quality standards in Lake Washington and Puget Sound, with accompanying increases in fishing and shellfishing restrictions and public beach closures. This impact would reverse decades of work by Metro/King County to clean up the region's water quality. Ultimately, growth moratoria would be instituted to stem the increase in flows.

Refer to Appendix 3-J, Evaluation of the No Action Alternative, for more information.

9.3.6 Cumulative Impacts

The Brightwater System would significantly reduce environmental health risks compared to conditions without the system. As described under the No Action Alternative, overflows would likely increase over time without Brightwater and the proliferation of onsite septic systems may pose greater risks to environmental health. King County would continue operation and maintenance practices to minimize this risk. King County would continue to monitor research relating to potentially cumulative impacts associated with accumulation of constituents of concern in sediments and issues associated with the sea surface microlayer.

9.4 Significant Unavoidable Adverse Impacts

Potential impacts include the risk of emergency overflows and accompanying short-term environmental health risks associated with the overflows. Every effort would be taken to avoid emergency overflows. The overall risk of overflows and accompanying impacts in the Brightwater Service Area, as well as the entire King County wastewater service area, would be significantly reduced by implementation of the Brightwater System. Overflows and accompanying health risks would occur more frequently and likely be of higher volume without implementation of the Brightwater System. However, short-term impacts may be unavoidable under rare cases of severe storms or unpredictable environmental emergencies. In such cases, short-term impacts may be locally significant.

9.5 Summary of Impacts and Mitigation

Table 9-2 summarizes the potential impacts to environmental health from construction and operation of the Brightwater System alternatives, and it summarizes mitigation for these impacts.

Table 9-2. Summary of Potential Environmental Health Impacts and Proposed Mitigation for Brightwater Systems

Brightwater System	System Component	Impacts	Proposed Mitigation
Common to All Systems	Treatment Plant	<u>Construction</u> <ul style="list-style-type: none"> Potential to disrupt and expose contaminated soils or groundwater. If unmitigated, potential exposure of airborne particles to construction workers. Demolition at the site may expose workers to asbestos or lead. Potential spills or leaks of petroleum products, solvents, lubricants, and other materials used for construction equipment. 	<u>Construction</u> <ul style="list-style-type: none"> Conduct site work with contaminated soil in compliance with OSHA/WISHA regulations. Properly handle and dispose of contaminated soils, sediments, and groundwater in accordance with applicable regulations. Fence construction areas where appropriate to prevent public access. Develop Site Specific Health and Safety Plan. During construction, treatment plant underdrain systems will include leak detection below the water-holding basins. Pressure testing and construction QA/QC will also help reduce the risk of leaks. Require contractors to prepare and follow hazardous spill prevention plans and hazardous waste contingency plans. Spill containment provisions will be developed and response kits provided. These measures will be identified and described in a detailed Spill Prevention, Containment, and Control Plan (SPCCP) to be developed prior to construction. Spill prevention and cleanup provisions will comply with the Ecology 2001 Stormwater Management Manual for Western Washington. During demolition, use licensed abatement companies to remove materials containing asbestos or lead. Dispose material at licensed sites. Continue to work with local fire districts and emergency responders to develop emergency response programs.

Table 9–2. Summary of Potential Environmental Health Impacts and Proposed Mitigation for Brightwater Systems (cont.)

Brightwater System	System Component	Impacts	Proposed Mitigation
Common to All Systems (cont.)	Treatment Plant (cont.)	<p><u>Operation</u></p> <ul style="list-style-type: none"> • If unmitigated by project design, the potential exists for chemicals to spill or leak during plant operation. Greatest risk is to treatment plant operators. • Minimal risks of explosion due to stringent design requirements. • Minimal potential for security breaches or attacks on treatment plants. • Potential for airborne particulates, toxic chemicals, and pathogens if unmitigated by project design. • Potential temporary public health impacts from emergency overflows in the event of multiple equipment and power failures during storms. Potential exposure to those walking along or recreating in Lake Washington or the Sammamish River. • Possible exposure to biosolids during transfer or transport, or at an application site. 	<p><u>Operation</u></p> <ul style="list-style-type: none"> • Construct all facilities in accordance with Ecology’s Criteria for Sewage Works Design. • Store and use chemicals in compliance with the UFC, RCRA, OSHA, and local fire department permit requirements. • Contain potential airborne contaminants by cleaning and covering areas that could release contaminants and meeting air quality standards for site emissions. • Spill prevention measures such as leak detection systems, secondary containment, drainage retention, and regular inspection and maintenance will be developed consistent with the UFC, RCRA, OSHA, and other applicable regulations. Storage tanks will be designed with double walls, spill containment berms, alarms, level indicators, ventilation, and other features to minimize spill risks and impacts. • Route stormwater from chemical use and delivery areas through the treatment plant processes. • Provide controlled access to treatment plant, along with other security measures. • Follow established response procedures for emergency wastewater overflow events, should they occur.
	Conveyance	<p><u>Construction</u></p> <ul style="list-style-type: none"> • Potential exposure of workers or adjacent residents to materials that spill or leak, such as fuel or hydraulic fluid. • Potential to contaminate deeper aquifers by excavating through shallower, contaminated aquifers and aquitards at portals. • Potential release of contaminated dewatering water. • Minimal potential for release of ammonia during ground freezing. 	<p><u>Construction</u></p> <ul style="list-style-type: none"> • Provide spill containment measures similar to those discussed under Treatment Plant, above. • Seal portal shafts to minimize risks from fuel or chemical spills. • Conduct all dewatering in accordance with Ecology requirements.

Table 9–2. Summary of Potential Environmental Health Impacts and Proposed Mitigation for Brightwater Systems (cont.)

Brightwater System	System Component	Impacts	Proposed Mitigation
Common to All Systems (cont.)	Conveyance (cont.)	<u>Operation</u> <ul style="list-style-type: none"> Potential for spills, leaks, or other releases to environment. Potential rupture of force mains from cracks, weak spots, or construction activities. Minimal potential for impacts to drinking water supply. Tunnel alignments would be downgradient, distant, cross gradient, or vertically separated from groundwater drinking water supplies. Potential for generation of hazardous gases such as hydrogen sulfide or methane in conveyance system. 	<u>Operation</u> <ul style="list-style-type: none"> Comply with all applicable UFC design requirements and local fire departments to reduce environmental health risks. Design force mains to withstand operating and transient pressures; perform pressure testing. Establish and implement Brightwater System emergency response procedures for overflows, including beach postings, public notifications, and monitoring. Provide ventilation shafts to prevent gas buildup, and routinely monitor and inspect facilities.
		<u>Construction</u> <ul style="list-style-type: none"> Potential for spills and leaks of hydraulic fluid or petroleum products to wash onshore. 	<u>Construction</u> <ul style="list-style-type: none"> All in-water construction would be subject to spill containment requirements.
	Outfall	<u>Operation</u> <ul style="list-style-type: none"> Outfall discharge would meet or exceed state and federal water quality standards intended to protect health at edge of mixing zone. Potential contribution of increased nitrogen to algae growth is expected to be minimal. Cumulative cancer risks and non-cancer hazards from metals and organic chemicals would be no greater than under current ambient conditions. 	<u>Operation</u> <ul style="list-style-type: none"> Monitor effluent quality to ensure that effluent meets all NPDES permit requirements. Locate outfall in deep water near Triple Junction (where Admiralty Inlet and Possession Sound join the Central Basin at the south end of Whidbey Island) where currents will disperse effluent to minimize potential for human contact.
Route 9–195th Street System	Treatment Plant	<u>Construction</u> <ul style="list-style-type: none"> Same as Common to All Systems, above; impacts specific to this site are listed below. Potential exposure of workers or public to contaminated soils. One property onsite awaiting remedial action. Minimal risks to groundwater supplies from spills. Regional drinking water supply wells are upgradient of the site. 	<u>Construction</u> <ul style="list-style-type: none"> Same as Common to All Systems, above.

Table 9–2. Summary of Potential Environmental Health Impacts and Proposed Mitigation for Brightwater Systems (cont.)

Brightwater System	System Component	Impacts	Proposed Mitigation
Route 9–195th Street System (cont.)	Treatment Plant (cont.)	<u>Operation</u> <ul style="list-style-type: none"> Same as Common to All Systems, above; impacts specific to this site are listed below. Minimal potential for discharge of spilled materials to Little Bear Creek or domestic groundwater supplies. Potential for diversion of some wastewater to Puget Sound instead of Sammamish River in the event of an emergency overflow, reducing potential human health risks. 	<u>Operation</u> <ul style="list-style-type: none"> Same as Common to All Systems, above.
	Conveyance	<u>Construction</u> <ul style="list-style-type: none"> Same as Common to All Systems, above; impacts specific to this site are listed below. Potential for spills of fuels, oils, lubricants, and other chemicals at portals during construction along 15.9 miles of conveyance corridor. Greater number of portals (5 primary, 4 secondary) and longer corridor length compared to Unocal system would result in proportionately greater potential for construction impacts. Potential to encounter contaminated soils or groundwater at Portal 19. 	<u>Construction</u> <ul style="list-style-type: none"> Same as Common to All Systems, above.
		<u>Operation</u> <ul style="list-style-type: none"> Potential spills at Portal 5 dechlorination facility. Potential spills or releases of odor control chemicals at Portals 11, 41, 44. 	<u>Operation</u> <ul style="list-style-type: none"> Same as Common to All Systems, above.
	Outfall	<u>Construction</u> <ul style="list-style-type: none"> Same as Common to All Systems, above. 	<u>Construction</u> <ul style="list-style-type: none"> Same as Common to All Systems, above.
		<u>Operation</u> <ul style="list-style-type: none"> Same as Common to All Systems, above. 	<u>Operation</u> <ul style="list-style-type: none"> Same as Common to All Systems, above.

Table 9–2. Summary of Potential Environmental Health Impacts and Proposed Mitigation for Brightwater Systems (cont.)

Brightwater System	System Component	Impacts	Proposed Mitigation
Route 9–228th Street System	Treatment Plant	<u>Construction</u> • Same as Route 9–195th Street System, above.	<u>Construction</u> • Same as Common to All Systems, above.
		<u>Operation</u> • Same as Route 9–195th Street System, above.	<u>Operation</u> • Same as Common to All Systems, above.
	Conveyance	<u>Construction</u> • Same as Common to All Systems, above; impacts specific to this site are listed below. • Potential for spills at portals during construction along 20.3 miles of conveyance corridor. • Greatest number of portals (7 primary, 4 secondary) and longest corridor length among all alternatives would result in greater relative potential for construction impacts.	<u>Construction</u> • Same as Common to All Systems, above.
		<u>Operation</u> • Same as Common to All Systems, above; impacts specific to this site are listed below. • Potential spills at Portal 26 dechlorination facility. Potential spills or releases of odor control chemicals at Portals 11 and 41.	<u>Operation</u> • Same as Common to All Systems, above. • In addition, perform special studies for the 228th Street well of Olympic View Water District as required
	Outfall	<u>Construction</u> • Same as Common to All Systems, above.	<u>Construction</u> • Same as Common to All Systems, above.
		<u>Operation</u> • Same as Common to All Systems, above.	<u>Operation</u> • Same as Common to All Systems, above.

Table 9–2. Summary of Potential Environmental Health Impacts and Proposed Mitigation for Brightwater Systems (cont.)

Brightwater System	System Component	Impacts	Proposed Mitigation
Unocal System	Treatment Plant	<u>Construction</u> <ul style="list-style-type: none"> Same as Common to All Systems, above; impacts specific to this site are listed below. Confirmed soil and groundwater contamination currently being remediated. Potential exposure of workers or public to contaminated soils would be minimal following remediation. Potential impacts to groundwater supplies from spills or spreading of onsite contamination minimal. Regional drinking water supply wells are upgradient of the site. 	<u>Construction</u> <ul style="list-style-type: none"> Same as Common to All Systems, above.
		<u>Operation</u> <ul style="list-style-type: none"> Same as Common to All Systems, above; impacts specific to this site are listed below. Potential for influent to bypass site into deepwater outfall in the event of a plant failure. Deepwater offshore discharge point and dilution would not create any significant health risks. 	<u>Operation</u> <ul style="list-style-type: none"> Same as Common to All Systems, above.
	Conveyance	<u>Construction</u> <ul style="list-style-type: none"> Same as Common to All Systems, above; impacts specific to this site are listed below. Potential for spills at portals during construction along 11.6 miles of conveyance corridor. Fewest portals (4 primary, 4 secondary) and shortest corridor length compared to both Route 9 systems would result in lower potential for construction impacts. 	<u>Construction</u> <ul style="list-style-type: none"> Same as Common to All Systems, above.

Table 9–2. Summary of Potential Environmental Health Impacts and Proposed Mitigation for Brightwater Systems (cont.)

Brightwater System	System Component	Impacts	Proposed Mitigation
Unocal System (cont.)	Conveyance (cont.)	<u>Operation</u> <ul style="list-style-type: none"> Same as Common to All Systems, above; impacts specific to this site are listed below. No conveyance dechlorination facility required. Potential spills or releases of odor control chemicals at Portals 7, 11, and 14. Potential spills or releases of odor control chemicals including pump station at Portal 11. 	<u>Operation</u> <ul style="list-style-type: none"> Same as Common to All Systems, above.
		<u>Construction</u> <ul style="list-style-type: none"> Same as Common to All Systems, above. 	<u>Construction</u> <ul style="list-style-type: none"> Same as Common to All Systems, above.
	Outfall	<u>Operation</u> <ul style="list-style-type: none"> Same as Common to All Systems, above. 	<u>Operation</u> <ul style="list-style-type: none"> Same as Common to All Systems, above.
		<u>Construction</u> <ul style="list-style-type: none"> No impacts from construction. 	<u>Construction</u> <ul style="list-style-type: none"> No mitigation identified.
No Action Alternative		<u>Operation</u> <ul style="list-style-type: none"> Increase in overflows of untreated wastewater to Lake Washington, the Sammamish River, and other water bodies. Increases in health risks associated with overflows from swimming, boating, or otherwise recreating near overflows. 	<u>Operation</u> <ul style="list-style-type: none"> No mitigation identified beyond existing King County procedures to post spills and notify the public.

9.6 References

- Apedaile, E. 2001. A perspective on biosolids management. *The Canadian Journal of Infectious Diseases* 12:4. July/August 2001.
- Alston, Allen, King County Safety and Health Administrator IV. Personal communication, memorandum to Shirley Marroquin, King County and David Wortman, Adolfson Associates, October 2003.
- Beverly, S., Lukasik, G., Condon, W.J., and D. MacIntyre. 2002. *Innovative disinfection processes including membrane technology and ultraviolet light for treatment of reclaimed water for indirect potable reuse*. Paper for the Water Environment Specialty Conference. February 2002.
- Cox, E. 2002. E. Cox, King County Wastewater Treatment Division, Seattle, WA. Personal communication, September 2002.
- Dawson, M. 2003. Mick Dawson, Senior Operator, West Point Treatment Plant. King County Department of Natural Resources and Parks, Wastewater Treatment Division, Seattle, WA. Personal communication in telephone conversation, June 17, 2003.
- DOH (Washington State Department of Health). 2002. *Recreational beach shellfish closures due to biotoxins or pollution*. Retrieved from <http://ww4.doh.wa.gov/gis/biotoxinhelpt.htm>
- Ecology (Washington State Department of Ecology). 1998. Criteria for sewage works design. *Ecology Publication* 98-37 WQ. December 1998.
- Edmonds (City of Edmonds, WA). 2001. *City of Edmonds Parks, Recreation and Open Space Comprehensive Plan*. Prepared by JC Draggoo/MIG, Inc.
- Eggebrecht, A. 2002. A. Eggebrecht, Husky truck sales. Personal communication, August 2002.
- EPA (U.S. Environmental Protection Agency). 2003. *PLUMES*. Version 3.0. Retrieved from the EPA Exposure Assessment Models Web site, last updated July 10, 2003: <http://www.epa.gov/ceampubl/swater/plumes/index.htm>
- Feachem, R.G., Bradley, D.H., Garelick, H., and Mara, D.D. 1983. *Sanitation and disease health aspects of excreta and wastewater management*. New York: John Wiley and Sons.

- Illinois Division of Environmental Health. 2002. *Fact sheet on Hydrogen sulfide gas*. Retrieved August 4, 2002 from <http://www.idph.state.il.us/envhealth/factsheets/hydrogensulfide.htm>
- King County. 1998. *Final Environmental Impact Statement for the Regional Wastewater Services Plan*. Seattle, WA: King County Department of Natural Resources.
- King County. 2000. *Biosolids and grit haul driver's handbook*. Seattle, WA: King County Department of Natural Resources, Wastewater Treatment Division. June 2000.
- King County. 2001. *Preliminary survey of recreational uses of the Puget Sound shoreline in northern King and southern Snohomish Counties*. Prepared by Parametrix, Inc., Kirkland, WA, for King County. Seattle, WA.
- King County. 2002a. *Brightwater Marine Outfall: Puget Sound marine monitoring report*. Seattle, WA. October 2002.
- King County. 2002b. *Results of human use survey of Puget Sound shorelines*. King County Department of Natural Resources.
- King County. 2002c. *2001 Biosolids quality summary*. King County Department of Natural Resources and Parks, Wastewater Treatment Division, Technology Assessment and Resource Recovery. Seattle, WA. August 2002.
- King County. 2002d. *Wastewater treatment division overflow manual*. King County Department of Natural Resources and Parks, Wastewater Treatment Division, *Safety Office Publication 115*. Seattle, WA. November 2002.
- King County. 2003. *Emergency Support Function 3, Public works, surface/wastewater, and solid waste*. In *King County, Washington Emergency Management Plan*. Seattle, WA.
- Murray, M., and Ferguson, L. 1998. The status of marine protected areas in Puget Sound. Vol. II, MPA site profiles & appendices. *Puget Sound/Georgia Basin Environmental Reps.* 8. 397 pp.
- Parametrix. 2001. *Analysis of human use of Puget Sound shorelines*. Prepared by Parametrix, Inc., Kirkland, WA, for King County Department of Natural Resources. Seattle, WA. September 2001.
- Parametrix and Intertox. 2002. *Phase 3 Brightwater Marine Outfall water quality investigations*. Prepared by Parametrix, Inc., Kirkland, WA, and Intertox for King County Department of Natural Resources. Seattle, WA. October 2002.
- West Consultants and King County. 2002. *Phase 3 initial dilution assessment of potential diffuser zones. MOSS plume modeling: Continuous discharges to Puget Sound*. Seattle, WA. October 2002.

- Wood, W. 2003. Wyatt Wood, Construction Manager 3, Inspections and Scheduling. King County Department of Natural Resources and Parks, Wastewater Treatment Division, Seattle, WA. Personal communication in telephone conversation, June 17, 2003.
- Woolrich, B. 2003. Bob Woolrich, Washington State Department of Health, Olympia, WA. Personal communication in telephone conversation.
- Yahya, M., Reed, C., and McGee, C. 2000. *Fate of indicator microorganisms during primary and secondary wastewater treatment processes*. Water Environment Federation. October 2000.